

The Journal  
OF THE  
Royal United Service Institution.

VOL. XXIV.

1880.

No. CIV.

THE NAVAL PRIZE ESSAY, 1880.

“NAVAL TACTICS ON THE OPEN SEA WITH THE EXIST-  
ING TYPES OF VESSELS AND WEAPONS.”

By Captain the Honourable EDMUND R. FREMANTLE, C.B., C.M.G., R.N.

“Nil sine magno vita labore dedit mortalibus.”

CHAPTER I.—*Modern Weapons.*<sup>1</sup>

IN these days we are far removed from the charming simplicity attaching to the old conditions of a naval engagement, when there was no dispute as to the vessels or weapons to be used, and only ships of two or three decks, with their broadsides of forty or fifty guns, were admitted to the honours of the line-of-battle. That frigates were not to take any part in a general action was admitted on all sides; while the only question hotly debated in the pages of James, was as to whether sixty-fours were entitled to rank as ships of the line.

Now we are rather in the position of the challenged in the days of duelling, viz., that we have the choice of our weapons, with the marked difference that our challenger has also the choice of his. What are these weapons to be? The ram, the gun, the torpedo, are all available for use in the open sea, as “existing types of weapons,” in the terms of the subject given for the Essay. Which shall we use? Can we use all three in the same ship, and, what is more, at the same time? These are questions which it becomes our business to answer.

The next question which inevitably occurs as a corollary is: Having chosen our class of ship and our weapon, to which family shall it belong? Shall we have specimens of different families of the same genus acting in concert, or shall we put all our eggs into one basket and stick to one class for all purposes?

<sup>1</sup> On the recommendation of the Referees, the introductory chapter has been omitted.—Ed.

The choice before us is so large, that it will be best to lay down certain limits to our inquiry.

Let us then compare:—

- (1.) The power of the ram.
- (2.) The power of the gun.
- (3.) The power of the torpedo.

Let us take, first, the ram as a weapon of offence. Its power lies, *First*, in the shape of the beak or ram: for, as with the gun, it is evident that the "energy per inch" of ram or spur in contact with the side of an enemy is the true figure of the penetrative power. That there is some limit to this, in consequence of the danger of the spur being wrenched off the attacking ship, may be admitted, but practically we prefer the sharper snouts of the "Nelson," "Inflexible," "Thunderer," and other modern ships of our own and of the French Navy, to more moderate spurs, advocated by Commander Noel.<sup>1</sup> It is probable that we shall see the snout in its extreme form in the novel ram "Polyphemus."

*Secondly*. The speed of which the ship bearing the ram is capable, being the propulsive force.

*Thirdly*. The turning power or handiness of the ship, being its power of being used in various directions.

*Fourthly*. The size or weight of the ship.

In all these points the gun may compare with the ram, having an unquestioned advantage under the first three heads, and a disadvantage in the last point. There is, however, one all-important matter which makes the ram so favourite a weapon. With the gun, it is only by rare good luck that penetration can be effected below the water-line; and the most that can be expected is, to sink a ship by a few fortunate hits "between wind and water." The ram, on the contrary, if it hits at all, strikes in a vital point; and though, as we shall see, it is not necessarily as fatal under all circumstances as is popularly supposed, yet no ship can expect to survive a direct blow of a ram from a heavy ship moving at fair speed.

The sinking of the "Cumberland" by the Confederate States' frigate "Merrimac" in Hampton Roads, during the American War, first opened the eyes of naval strategists to the power of the ram; but it was not till the action of Lissa, in 1866, that the question of weapons may be said to have been decided in favour of the ram in popular estimation.

Tegethoff not only used his ram as the effective weapon, but, after the first charge, the broadside guns were secured, and only bow and stern guns kept in action. We do not wish to quote this as by any means conclusive. The Austrian ships had no plate-piercing guns, and the ram became practically their only weapon, which Tegethoff deserves the credit of appreciating. It must also be remembered that, when Lissa was fought, the Whitehead torpedo was not invented. Still the fact remains, that from Lissa dates the all but universal agreement of naval Officers of all nations as to the ram being the

<sup>1</sup> "Great Britain's Maritime Power." Written for the Naval Prize Essay, Royal United Service Institution, 1877.



weapon *par excellence*. The "Re d'Italia," whose rudder had previously been damaged, was sunk by the "Ferdinand Max" by a determined effort, after some unsuccessful attempts, it is true, but the catastrophe which sent the flag-ship of the unfortunate Italian Admiral Persano and her crew to the bottom was so sudden, so complete, so tragic in its details, that it took the naval world by storm.

The Russian Admiral Boutakof, the French Admirals Bouet-Willamez, Jurien de la Gravière, and others, such as Admiral Bourgois, and Captain Lewal of the French Navy, indeed, all foreign Officers who have written on this subject, have assumed the ram to be the weapon of the day. The French system of naval tactics, which had only been issued in 1861, was again altered a few years subsequently as inapplicable to attack by the ram (*pointe*), as it appeared to the French authorities that rectangular movements were dangerous in an action to be decided by rams.

In our own Navy the views have been almost equally decided in favour of the ram. Certainly, none of our naval architects would now dream of building an ironclad without a ram.

In the Junior Naval Professional Essays for 1862, all the authors of the published Essays agreed in giving the prominent part to the ram. Lecturers at the Royal United Service Institution, Captains Colomb, Dawson, Bridge, and the speakers at the evening meetings, have generally taken the same view. Admiral Randolph is quite as strong on the subject in his lectures and recently published "Problems."<sup>1</sup> It is to be remarked, nevertheless, that the English opinion is scarcely as decided or enthusiastic on the subject as that of foreign authorities.

Captain Colomb, for instance, in his War Game, to which we shall allude more fully subsequently, takes the part of a ship which has no intention of ramming, and proposes to gain a victory by his broadside guns; though, in a former paper read at the Royal United Service Institution in 1871, he appeared to be more decided both as to the reduction in power of the gun, and the importance of the ram.

Of the ram, he then said, "So far from ramming being a difficult or impossible task, it is a thing that can be accomplished by superior skill with vessels otherwise equal."

Admiral Randolph, again, in his "Problems" before alluded to, although his tactics are mainly based on the ram, gives as his first postulate:—"That the maximum power of attack requires the 'freest possible use by each ship of its ram and artillery (torpedo included), without injury to friends.'"

Such, then, is the strength of professional opinion. Let us turn now to the theories and facts themselves on which these opinions are presumably founded.

The power exercised by the stem of the "Polyphemus," assuming her to be ramming at her extreme speed of 17 knots, would be 32,000 foot-tons, or more than that of the 80-ton gun, at the muzzle, which is only 27,000 tons; her great speed here coming in as a prime factor in the problem.

<sup>1</sup> "Problems on Naval Tactics." By Vice-Admiral Randolph.

With a larger ship a smaller speed would suffice, but from the well-known formula  $\frac{WV^3}{2g}$  it is evident that speed is of greater importance than size; thus it will be found that it would require a ship of nearly 8,000 tons at 10 knots speed to perform the same work as the "Polyphemus." Of the power of the ram itself we have numerous instances both in peace and war.

In war we have the destruction of the "Cumberland" by the "Merrimac," and that of the "Re d'Italia" by the "Ferdinand Max," before alluded to. In the present year we have had fresh illustrations of ramming in the exploits of the Peruvian ram "Huascar," and it is a subject of regret that correct information is not likely to be forthcoming on the naval actions between the Chilians and Peruvians, as they must be full of "wise saws" in their "modern instances" of naval combats.

As we write the "Huascar" appears to have fallen a victim to her opponents, but we have no particulars.

Enough is however before us to show how powerful the ram is; yet if we look beneath the surface we shall find that in all the cases above referred to, the successful blow has been preceded or followed by unsuccessful efforts. The "Merrimac," as is well known, although successful against the "Cumberland," either from insufficient speed or a damaged prow, failed to sink the little "Monitor," although she several times attempted to ram her.

The "Ferdinand Max," again, did not succeed in her first attempt, and although all the Austrian and some of the Italian ships tried ramming tactics, hers was the only successful effort, even the wooden Austrian line-of-battle ship "Kaiser," although rammed by the "Affondatore," remaining afloat.

The "Huascar," again, although she sank the "Esmeralda" after several attempts, failed on other occasions; so that, fatal and conclusive as a well-delivered blow from a powerful ram must inevitably prove, it is evident that no blundering, half-hearted collision will suffice to sink an opponent, but that the ram must be made determinedly and the blow struck at high speed and as near as possible at right angles to the enemy's course.

Our illustrations from peace service and accidental catastrophes are unfortunately more numerous and instructive than those deduced from the rare occasions afforded by modern naval war. We may discard the collisions of merchant ships, or of men-of-war with merchant ships, such as H.M.S. "Amazon" with the "Osprey," or of the United States corvette "Oneida" with the "Bombay," for in men-of-war with men-of-war enough remain for our purpose.

Of two successful collisions, those of the "Iron Duke" with the "Vanguard," and of the "König Wilhelm" with the "Grosser Kurfürst," are the most familiar and instructive. In both cases heavy ships at moderate speed sunk their unfortunate consorts by one blow delivered at an angle of 20° to 30° from the perpendicular to the course of the other ship. In the case of the German ship "König Wilhelm" she was nearly sunk herself, having no collision bulk-

head, and her ram being unsupported; but the "Iron Duke," on the other hand, was practically uninjured.

The "Grosser Kurfurst" was a turret-ship with little reserve of buoyancy, and sunk in twenty minutes, the majority of the crew being drowned. The "Vanguard" remained afloat for seventy minutes, and all her crew were saved. The difference in these cases points to the necessity for having an "iron built armoured ram bow,"<sup>1</sup> and also to the use of double bottoms, as we shall see presently.

As there seems to be some misunderstanding as to this question of rams and armour, it may be worth while to deal more fully with this subject.

In April last, during a discussion at the United Service Institution, Admiral Sir George Elliot expressed his decided preference for the "Dreadnought" over the "Inflexible," on account of the greater strength of the former's bows through having her armour-plating carried right forward; and he was answered by Mr. Scott Russell, who wished to rid his hearers of "the supposition that the armour in the bow of the ship is of the least use in giving the strength necessary to make her a better ship in case of ramming."

Now we hold that the Admiral was substantially correct, and it is certainly an important point to be considered by either rammer or rammee.

The following extract from Mr. White's work before alluded to is interesting as bearing on this question, and though rather long we cannot refrain from quoting it. He says, speaking of the "Iron Duke" and "Vanguard" collision:—

"At the time of the collision the 'Iron Duke' is said to have been going  $7\frac{1}{2}$  knots, her course being six points off that of the 'Vanguard'; the direct force of the blow delivered was 12,000 foot-tons. Fig. 26, page 35, illustrates the damage done to the 'Vanguard,' the armour being driven in bodily, and the outer bottom pierced by a huge hole some 30 or 40 feet in area. Such a blow of course reacted on the bow of the 'Iron Duke,' tending to drive it back into the ship; and meanwhile the 'Vanguard' had a speed athwart the bow of the 'Iron Duke' of no less than 6 knots, the motion producing a tendency to twist and wrench the bow as well as to perforate the skin. The simple and comparatively light arrangements of the ram-bow answered admirably when thus severely tested, subsequent examination proving it to be so little damaged that the 'Iron Duke' could in action have ventured safely on a repetition of the blow, and yet have remained efficient. Special interest attaching to this matter, Figs. 93-95, has been drawn to illustrate the principal features in the framing of an iron-built armoured ram-bow, and only a few explanatory remarks will be required.

"The stem is a solid iron forging weighing several tons. Against direct strains tending to force it backward it is supported by longitudinal frames or breast-hoops, as well as by the armour-plating,

<sup>1</sup> "Manual of Naval Architecture." By W. H. White, Assistant Controller, Royal Navy.

"backing, and skin plating, all of which abut against the stem. . . .  
" . . . Perforation of the skin is rendered difficult either by carrying  
"the armour low down over the bow or by doubling the skin plating  
"forward below the armour.

"The former plan is preferable, being more efficient against perforation, and also giving protection against raking fire when engaged bow-on to the enemy. It has been very generally adopted of late in the Royal Navy, and the French also favour this plan.

"Such are the main features of the ordinary ram-bow in an iron built ironclad ship."

In another place Mr. White speaks of the armour shelf of the "Vanguard" as bringing up the "Iron Duke," and while he advocates very strongly double bottoms and internal subdivisions, he intimates pretty clearly his opinion in corroboration of the general Service view that the "Vanguard" would not have been lost had the wing passages or inner skin been carried up to the main deck, as in previous ships.

We have dealt so long on this subject as every Officer should be well acquainted with the strength and weakness of his ship, and it is idle to talk of ramming if no confidence is felt in the strength of the vessel intended to use the ram. Our naval readers will all recall numerous instances of small accidental punctures to the thin iron skins of formidable ironclads, and in the rough test of ramming they will feel more confidence in those ships whose water-line is protected by armour-plating, which is a thick hide not easily pierced, and which can and, as we have seen, does, in our modern ships add to the strength of the structure.

In an account of the French ship "Amiral Duperré," given in Vol. XXIII of the Journal of this Institution, we are told that "her stem is of wrought iron in the form of a ram, and receives the butts of the water-line armour-plates; the lower edges of which are brought down forward nearly 10 feet below the water-line to the very point of the ram."

The "Dugueslin," another French ship, is stated to have "a ram in the form of a snout, tipped with a metal coating, of extraordinary length."

It would appear that more attention has been paid to this important question of ram-bows in foreign navies than in our own. It is true that the strength of our bows is probably all that can be desired; they are in the "Inflexible" and other modern ships attached to the fore end of an armoured deck, which supports it<sup>1</sup> most efficiently "against direct and wrenching strains," but it is difficult to feel equally satisfied with the strength of the whole side of the ship which has no thick armour to resist penetration and distribute the crushing strains over a sufficiently large area. It has always struck us as possible to have improved upon the American plan of an overhang, and to have an armoured deck projecting outside the skin of the ship four or five feet,

<sup>1</sup> "Naval Architecture." By Mr. White.

which would at least force the enemy to have an inordinately long spur, which would make but a small hole. In these days of bilge keels and batteries projecting from the ship's side, even such an excrescence as we have suggested would appear to be worthy of consideration if, as we believe, it would afford a reasonable protection against a ram-blow.

That it would be a sort of counter-ram of some danger to the ramming ship is evident, and we would propose that it should taper towards the bow and stern, having only its full breadth in the most vulnerable part amidships.

We have alluded now to successful, though accidental rams, but, in accordance with our contention that all rams, even from heavy ships, unless striking normally at considerable speed, are not fatal, we may refer briefly to a few such in our own Navy.

Thus we have had collisions between the "Minotaur" and "Belleville," between the "Hercules" and "Northumberland," in which cases double-bottoms, wing-passages, and compartments proved so efficient that, although considerable injury was done by the ram, the rammer was able to continue on service as if nothing had happened until it was convenient to repair her.

This, then, is the case for the ram. It is a most formidable weapon, although not quite so fatal as is popularly supposed, and in foreign navies it is unmistakably given the first place. Let us turn now to the guns.

We cannot afford space for an elaborate enquiry into gun-power, nor does it bear so directly as the ram on the subject for the Essay. It is a truism to say that to make a good use of the gun, a single ship or a fleet must be properly manœuvred, but if the gun is to be depended upon, the tactics become simpler and culminate in an attempt to keep the broadside of your ship at a certain fixed distance from the enemy.

The gun can be used without the ram, but if the ram is used, guns can always be made serviceable to supplement its action.

To attempt the former in a fleet action against an enemy determined to ram would evidently be not only demoralizing, but disintegrating. No system of tactics could be framed contemplating such a state of things.

It may still however be held, that, while using ramming tactics and being ready to ram, from mutual failures to strike a successful blow, the action may after all be decided by the gun, and that whilst beginning by taking a subordinate part, it would finish by being the principal agent in success or failure. We cannot, therefore, ignore its position, although we do not propose, for the above reasons, to attempt a critical examination of its power.

Our ships are now armed in every different way conceivable. We have ships entirely armed with a few heavy plate-piercing guns, such as the turret-ships "Inflexible," "Ajax," "Agamemnon," "Neptune," "Monarch," "Dreadnought," "Thunderer," and "Devastation," some of these being intended for broadside and some for end-on fire, the ram forming an important part in their fighting qualities.

In older ships, such as the "Warrior," "Black Prince," "Resis-

"tance," "Defence," "Achilles," "Hector," "Valiant," "Northumberland," "land," "Minotaur," and "Agincourt," we have, as Captain Colomb tells us,<sup>1</sup> "only faint indications of an opinion in favour of end-on fire," while the ram, which has no existence in the "Warrior" and "Black Prince," can scarcely be said to be intended for serious use in such long vessels as the five-masters.

Obviously in vessels not intended to use the ram the gun must have the first place, and if the "Warrior" and her sister ship the "Black Prince," or even the "Minotaur," "Achilles," "Northumberland," and "Agincourt," are to take their part in a modern fleet, the ram must be subordinate to the gun.

Generally, as has been ably pointed out by Captain Colomb,<sup>2</sup> who is the only authority to whom we can appeal as having even attempted to solve the relative positions of the gun and the ram, the fewer the guns carried, whatever their size may be, the greater the trust which must be reposed in the ram. Heavy broadsides, even from numerous 9-inch and 10-inch guns, in these days of thick plating and partial protection, are probably more demoralizing and effective than the lesser number of shot from larger guns.

The old adage about "not putting all your eggs into one basket" applies equally to guns as to ships. As Nelson said, "In a naval action something must be left to chance," and those who fire the largest number of shots must have the greatest number of chances.

In Commander Noel's Essay on "Great Britain's Maritime Power," he shows, by an elaborate table, that thirty 12-ton guns might in ten minutes fire fifty tons weight of shot, with a total energy of 696,600 foot-tons, at 4,000 yards, twenty 18-ton guns, in the same time, throwing thirty tons weight of shot, with a total energy of 454,750 foot-tons, at the same distance. In the case of the 12-ton guns, there are reasons for supposing that the data taken by Commander Noel from the prize firing of the "Iron Duke" and "Triumph" are unusually favourable, and there is certainly some virtue in having the larger gun where the disproportion of weight of shot and energy is not considerable. Further, we know from official data that the 12-ton gun will penetrate  $11\frac{1}{2}$  inches of unbacked armour at the muzzle,  $9\frac{1}{2}$  inches at 1,000 yards, and 8 inches at 2,000 yards, while the 18-ton gun will penetrate  $14\frac{1}{2}$  inches,  $12\frac{1}{2}$  inches, and 11 inches respectively, under similar conditions.

It will be found, then, that at 4,000 yards, the distance taken by Commander Noel, the penetration of the 18-ton gun would be 8·7 inches, against 6 inches for the 12-ton gun, and at that distance the actual penetration of armour-plating would stand, in round numbers, as 3,949,800 inches for the 18-ton gun, against 4,176,000 inches for the 12-ton gun, thus reducing the two guns to almost an equality.

We will not pursue this subject any further, as doubtless many will

<sup>1</sup> "Broadside Fire and a Naval War Game." Lecture at the Royal United Service Institution, 1879.

<sup>2</sup> "Attack and Defence of Fleets." Lecture at the Royal United Service Institution, April, 1871.

be ready to say that it is only another instance that anything can be proved by figures.

Our endeavour has been to hit off a fair medium for a broadside ship between heavy and light guns, and to combine sufficient penetrative power with a good weight of broadside and such a shower of projectiles as would give us some chances of lucky shots in our favour.

As to probability of hitting, we have literally no good means of judging, as even Captain Colomb's attempt in this direction, drawn from prize firing and the "Vigo" experiment, can scarcely be regarded as successful.

We are not even accurately informed as to the relative value of broadside or independent firing, broadside or end-on fire, electric or manual firing. On the first point, at least, we may ask for more information, which could be easily drawn from experiment. We are aware that some attempts in this direction have been made by the French Government at Gavre, but they are certainly not conclusive, as far as we are informed. It would appear, however, that the general opinion, which has advocated broadside fire as the most likely to give satisfactory results against iron plates, is well founded.

In an elaborate paper, translated from the *Revue Maritime et Coloniale*, by Lieutenant Lees, R.N., an attempt is made to solve the problem of "the best mode of firing guns in a naval engagement," but in spite of the ingenuity and theoretical accuracy of the tables drawn up by Mr. Lucca, of the Italian Navy, it is evident that but little reliance can be placed upon them.

The table attached to Captain Colomb's "Naval War Game," based on penetration, on the size of the object to the eye, and the striking angle due to the relative course of the two ships, is probably as accurate a guess as can be made, and he gives no value for ranges over 2,000 yards.

On the vexed question of broadside *v.* end-on fire we can only give our own views, with which we believe that the majority of naval Officers will agree.

To leave a ship without bow or stern fire would seem suicidal. As pointed out by Admiral R. V. Hamilton (Director of Naval Ordnance), in his lecture on the "American Naval Engagements," vessels in proceeding up rivers, or in attacking forts, must require bow fire. In single ship actions, again, as was often found in the old wars with sailing ships, bow and stern guns frequently decided the result. Now they will be more than ever required.

What is to be done with an enemy of equal speed who persists on lying on your bow, if you have no bow fire? You can run away, of course, or give him a broadside, and allow him to escape you, but you must give up what would be the most advantageous position for a ram with good bow fire. Still worse, what is to be the fate of a ship without stern fire against an enemy with good bow fire, of equal speed, which gets within 500 yards astern?

As Admiral Elliot said of a ship in such a position,—“That ship is “mine.” Nothing but stern fire or the Whitehead torpedo could save her.



We hold, at the same time, that to sacrifice broadside for bow fire, or to make the former subservient to the latter, is an entire mistake, except in vessels built for special circumstances, as the "Gamma" class of gunboats, but when carried to the point it has been in the "Alexandra" and "Téméraire," which are intended for fleet ships, we cannot but consider it a mistake.

In the "Shannon," "Nelson," and "Northampton," on the other hand, while broadside protection has been dispensed with, broadside fire has not been materially interfered with, and their case can be defended on other grounds.

We hold, however, that bow and stern fire are essential, and we go further, and as will, we think, be clearly seen when manœuvres of single ships are considered, we hold the necessity for a heavy stern fire as of primary importance to that of bow fire.

If, however, our view of a fleet action is correct, a heavy broadside is a necessity, and in a general action end-on fire is of secondary importance.

Of improvement of guns by chambering, we have taken but little notice, as, although the 38-ton gun, for instance, has with an increased charge had its energy per inch of shot's circumference raised from a figure of 287 at the muzzle to 350, an equivalent will probably be found in the substitution of steel for iron plates, or in a mixture of the two, as in the "Agamemnon."

Assuming Jurien de la Gravière's axiom as correct that, in a fleet intending to ram, no shot must be fired in advancing towards the enemy, it becomes almost a necessity that the fire should be opened by a broadside. What is the best method of delivering this broadside? The service plan would be that it should be delivered by electricity, by an Officer of cool head and good judgment. Against this we have Admiral Randolph's great experience.<sup>1</sup> He draws a Byronic picture of the Officer awaiting the moment when, without even a gesture of command, by

"A finger's pressure, nothing more,  
 "The ponderous cannons' thundering roar,  
 "A passing cloud of smoke, and lo!  
 "The waves engulf the haughty foe."

This, says the gallant Admiral, is a dream, his view of it evidently being—"C'est magnifique, mais ce n'est pas la guerre."<sup>2</sup> In another paper he argues the question of electric firing more fully, but it is evident that he does not believe in broadsides, and that independent firing is his aim. He points out truly that to continue broadside firing in a general action would be too great a tax upon any Captain's powers, and that it must end in failure. Here we agree with him, but it will be all-important that there should be no premature firing, and to prevent this let the first firing be under the direction of the Captain. Then, if you like, "Cry havoc and let slip the dogs of war," but the first object of a Captain should be to bring his men to close quarters

<sup>1</sup> Lecture, Royal United Service Institution, January 24, 1879.

<sup>2</sup> Lecture, Royal United Service Institution, February 21, 1879.



with the enemy while still cool and under command. It is certain that there will be less excitement and more careful firing subsequently. As in a bayonet charge, which is so often successful because the side having resort to it has more men under command ready to come to close quarters, so by reserving your fire and bringing your men alongside the enemy, unruffled and probably lying down to escape the first fire of your opponent, you gain an immense advantage.

We can propose, on these grounds, nothing better than electric firing by director, for the first broadside, though there should be an alternative of electric firing by the "directing gun" to be used by the Officer of the battery should any accident happen to the Officer at the director.

A word on directors and concentrated fire. The former are too elaborate. There are corrections to be applied for everything, many of which might be eliminated by a simple method. Why, for instance, is it necessary to concentrate at every convenient distance and bearing, and to apply corrections to every gun? Would it not be clearer to return somewhat to the older method of only concentrating at certain fixed bearings and distances?

We would propose—

Close alongside—abeam.

500 yards, 10° before the beam, abeam, and 10° abaft the beam.

800 yards,

For these distances the marks might "be plainly shown on the racers, and the dip, &c., similarly allowed on the director, by having three arcs engraved on it, the only correction remaining to be made on the latter being that due to the speed. We hold concentrated broadsides over 800 yards to be impractical, though if required, it is evident that good shooting would be made by firing a broadside laid for 800 yards, at 1,200 yards distance.

It is true, that we are substituting a rough and ready system for a nominally more accurate one, and that no real concentration close alongside would be possible, but those who have remarked how often corrections are wrongly applied, in drill and by seamen gunners Nos. 1, will probably agree with us that some attempt at greater simplicity is absolutely requisite. We hold, too, that there is a necessity for our guns giving greater depression. An attempt to ram misses, and ships are about to grind their broadsides together. Foreseeing this probability, orders have been sent to the battery to lay all the guns for "close alongside on the beam," with the intention of firing at the enemy's water-line at the moment of broadside collision; the guns are fired accordingly, but for a want of sufficient depression, the shots do not take effect as intended; if at a "Polyphemus," or low ram, or monitor, the shot will go over her, repeating the experience of the "Speedy" and "Gamo," and there will not be wanting bold seamen to follow Lord Cochrane in trading upon this weakness of large ships.

Most of our ironclads can only give 8° depression from their main deck guns, and but little more from their upper deck guns. Assuming the muzzle of the gun to be only 11 feet from the water, and the gun to have 8° depression, it will be found that the shot will strike the water if the ship is on an even keel at 80 feet distance. If fired from an

upper deck gun, say 30 feet above the water, and with  $9^{\circ}$  of depression, this distance is increased to 190 feet. If we are correctly informed, the barbette guns of the "Téméraire" are capable of giving but little depression, and it would be interesting to know at what distance the shot from these guns could strike the water-line of another ship. We consider this question of being able to give sufficient depression to all guns, especially in large ships, as one of the utmost importance, and we trust that it will receive more attention than it has hitherto.

As connected with gun-fire, the compass must not be overlooked. The compasses now supplied for firing are fairly efficient, but it is a point which has not been sufficiently considered. Sir William Thomson's compass, which has been so highly spoken of in many respects, would probably stand fire well, but we are not aware of any report of this subject from either the "Minotaur" or "Thunderer," in which ships alone it has been tried.

The method for communicating orders from the upper deck or the conning tower, certainly needs improvement. Neither voice-tubes nor messengers are sufficiently to be depended upon, but with a greater simplification of the director as we have proposed, a telegraph and dial, such as that used for the engine-room, would answer all purposes, and might be fitted in all large ships.

In dealing with the gun and the ram, we are to some extent on the solid ground of experience; with the torpedo, we must, perforce, look more to theory than to practice.

The torpedo is in its infancy; the Whitehead has had no opportunity of showing how it stands the rough test of real warfare, while the Harvey and the outrigger are scarcely adapted for use in an action in the open sea.

Of ground or stationary torpedoes, we need not speak here, but in the late American War, carried on chiefly in shallow rivers and lagoons, they proved fatal to no less than 25 Federal and 4 Confederate vessels, 3 of the latter being destroyed involuntarily, by their own torpedoes; and one Confederate ram, the "Alabama," was sunk by a daring attack by an outrigger. They show, at least, what had been doubted, owing to the non-success of the small-charge mines used by the Russians in the Baltic, that a good charge placed close to a ship's bottom was fatal.

Leaving ground-mines out of the question, let us turn to the offensive torpedoes. Of the Harvey, it might be sufficient to say, that notwithstanding the high favour in which it appeared to Commander Dawson, and many other naval Officers a few years ago, it has now been tacitly dropped, and large ships are allowed to return their Harvey torpedoes into store on application, but it may be worth while to give shortly our own views of its value.

When used from our large ships, it has generally failed to "dip" at all successfully, owing, no doubt, to the height at which it is towed, and we have seen it foul the screw by capsizing and turning in, instead of out. The French ships have a modified Harvey towed from

the top-gallant forecastle; and other foreign Governments have some variations of this torpedo, but although some of the defects may be obviated, we cannot believe in its being an effective weapon.

In official trials at which we have been present, it has been uniformly a failure. Either the "Grinder" was too fast, or the "Bloodhound" too slow, and in spite of the skill of experienced Officers, all attempts at effectively striking a vessel under weigh were futile.

Our own experience is, that it requires to be towed at exactly the right height, some 20 or 30 feet from the water, and at exactly the right speed, 7 to 8 knots, and under those circumstances, if very skilfully handled, it may possibly prove effective. Even then, it is almost as liable to endanger friends as foes, and it has been seriously proposed to continue their use solely as dummies, so as to frighten a nervous enemy from making use of his ram.

That such ruses have had their success we do not deny, but it will scarcely do to advocate as a principle a return to such Chinese practices as quaker guns and dummy torpedoes.

The Harvey has, however, been given up by its friends, so we need not waste words in "flogging a dead horse," for Commander Grenfell, who has had great experience in handling it, was subsequently generally acknowledged to have damned it by his very faint praise in a discussion at the United Service Institution.

The outrigger is a much more formidable weapon. From fear of the outrigger, ships will scarcely dare to lie at anchor in an open roadstead while blockading, and it might even be used with advantage from fast torpedo-boats of the "Lightning" class in a daring night attack against an enemy's fleet at sea.

But except under special circumstances, it would appear to be out of place in a fleet action. A fleet preceded by a cloud of torpedo-boats as skirmishers sounds well, but in real fight in daylight, at all events, they would stand little chance against torpedo guns and Gatlings.

As to using outriggers from large ships, it has always struck us as an attempt to put salt on a bird's tail. To go into action with outrigger booms from the bow or broadside, would interfere materially with the speed and steerage of the ship, while to drop an outrigger torpedo at the right moment under an enemy's bow or counter assumes too much skill on our own part, and too much simplicity on that of an adversary, to be seriously taken into account.

Between ships at all equal in size, when an outrigger could be used, the ram could replace it with much greater effect, though a small ship might boldly attempt to use it for want of a better weapon.

We hold then, for the above reasons, the Harvey and outrigger, or worse, the combination of both, to be the dream of arm-chair tacticians.

It will be seen that we discard also as unpractical any attempt at a defence outside the ship against the torpedo. "Porcupine drill" we hold to be useless, even when at anchor, while at sea it would be a fatal encumbrance.

Of the Whitehead torpedo, ingenious as it is, and with an unknown future, as daily improvements are made in it, we would speak with all respect, yet it is only a submarine gun or rocket of as yet uncertain value.

We say uncertain value advisedly, for whatever may be said in its favour by the Torpedo School, so far as our experience goes, when projected from a moving object, especially if from above water, when there is the slightest ripple its course cannot be depended upon. Our naval friends will recollect some erratic Whiteheads even in such close harbours as Malta and Queenstown, to which we need not further allude.

A close consideration must show how uncertain a missile it is. The service speed of pattern A Whitehead is  $12\frac{1}{2}$  knots for 300 yards, or 9 knots for 1,200 yards. The speed of the new pattern is to be  $16\frac{1}{2}$  knots for 800 yards, or 20 knots for 200 yards.

The "Polyphemus" is intended to discharge Whiteheads of the great speed of 23 knots, if such a speed is attainable. What we would point out is that even the highest of these speeds, marvellous as they sound, is ridiculous in a missile. How the unknown quantities of the speed of your own ship, which we know from the "Thunderer's" experiments is decreased nearly one-third when the helm is put hard over, and the speed and course of the enemy, which must be estimated, bear upon the course of the torpedo can be plainly seen when using the ingenious director adapted for its use. It might be as accurate as it is ingenious, if the data were correctly stated, but when one side and one angle at least must be guessed at, it is impossible to feel any confidence in hitting a moving object when the torpedo is fired from a ship in motion.

When tried in the "Actæon" at  $8\frac{1}{2}$ -knot speed, the deflection was found to be no less than  $38^\circ$ , and when discharged from the bow above water no accuracy of fire could at all be depended upon. There was an ugly story of a French ship having been run into on the quarter by her own Whitehead torpedo, which she had just discharged from the bow. We have a recent account of a torpedo discharged from the "Huascar," and the gallant Peruvian being only saved from being "hoist by her own petard" by one of her Officers swimming towards it, and diverting its course, of which we may say, "*Sé non e vero e ben trovato.*"

When fired from above water it is said to have less divergence, but to be less reliable.

We have said enough, not indeed to show that the Whitehead is useless, but to prove that it is still in its infancy. If we compare it with the gun, with its speed of 900 miles an hour, which allows of nice calculations of the speed of the ship being almost disregarded, the only necessity being to aim straight, even the 20-knot torpedo sounds absurd; yet it has one great compensating advantage in common with the ram in that, if it strikes at all, it strikes in a vital spot below the armour, and we know from the "Oberon" experiments that in spite of double bottoms, cellular compartments, coffer dams, and other arrangements, a Whitehead striking fair, even with the reduced charge in the

new pattern of 30 lbs. of gun-cotton, would do great, if not fatal, injury to an enemy.

We have endeavoured to point out the strength and weakness of the ram, gun, and Whitehead. With the turning power or handiness of the ram we intend to deal fully in another chapter.

The question now raised is, With what weapons shall we fight? And the answer must depend upon the character of the vessel and her armament. The "Warrior" must perforce fight with her guns or torpedoes, the "Polyphemus" with her ram or torpedo, while an "Alexandra" or a "Sultan" can use all three weapons. This, however, is not enough, and a further choice must be made. It cannot be too often insisted upon that a choice must be made of a principal weapon, the others being auxiliaries.

At Lissa it is clear that Tegethoff had made his election in favour of the ram, while Persano probably trusted to use any weapon which circumstances should render necessary, and we know the result.

This scarcely needs argument. A man who is armed with a sword, in addition to a gun, and has his belt lined with pistols, is either a buccaneer or a stage soldier, but in real warfare ashore, as afloat, we trust to one weapon, using others as auxiliaries, it may be; but we do not attempt to make use of more than one at a time. In a fleet action, as we have previously explained, unless both Admirals are agreed to fight it out entirely with guns, ramming tactics are compulsory; but in a single ship action, it is not so clear where the preponderance lies.

Captain Colomb, in his example illustrating his War Game,<sup>1</sup> and we believe that it is a fair specimen of the result of the majority of single ship engagements on paper, shows that his broadside ship, X, fires 28 shots in 10½ minutes, against the bow-gun ship's, Y, 15, the latter always attempting to ram. Eleven moves having now taken place and no ram having been effected, he gives the victory to X, which has scored 496 points to Y's 256.

We have quoted the War Game, which is a fair and ingenious representation of a single ship action under known conditions applicable to real warfare, to point out that, if correct, it shows not only that broadside is of more value than end-on fire, but that gun-fire is of at least equal value to ram-power, for Y never succeeds in ramming X, while the latter, whose main object is to use his broadside guns, wins by their fire.

It is to be observed, however, that X only narrowly escapes Y's ram, and that had the latter taken effect she would very properly have won the game.

After this illustration of the gun theoretically, we will conclude with a recent instance, which is highly suggestive of the relative value of different systems of armament, using the term in its highest sense to represent gun, ram, or torpedo.

In the action between the "Shah" and "Amethyst" and the "Huascar" we find that the Whitehead torpedo, although fired by the

<sup>1</sup> "The Naval War Game." By Captain Colomb. Griffin and Co. 1879.

"Shah," proved a failure, so far as we can judge, from the ships not remaining stationary within fair range, which we have seen to be only some 900 yards.

The ram too failed to act, although from Admiral de Horsey's report, it would appear that his movements were much interfered with by a well-grounded fear of the "Huascar's" ram.

What, however, are we to say to the guns? In an action of two and a half hours, according to Captain Colomb, and acquiesced in by Admiral Hamilton, Director of Naval Ordnance, we find the "Shah" firing 241 shots, the "Amethyst" 190, and the "Huascar" only 8, the "Huascar's" however, being 300-pounders. Of the shot fired by the English ships only 9 struck the "Huascar".<sup>1</sup> Fortunately none of those fired by the latter struck either of the English ships. Captain Colomb states that the result was no surprise to him, as he had on former occasions argued that only about "2 per cent. of the shot fired" would strike an object in action."

After all there is nothing astonishing in this; theoretical gunnery and firing at a mark with a small-bore at Wimbledon are both useful and instructive, but even in a land battle it used to be held that it required the weight of a man in lead for each victim, and we doubt whether Ginghilovo would afford more satisfaction from the Hythe point of view than the "Shah" and "Huascar" engagement did to the "Excellent."

With this practical illustration, we leave the question of weapons for that of evolutions and tactics.

#### CHAPTER II.—*Ramming Tactics—Single Ship Actions.*

"In modern steam fleets," says Jurien de la Gravière, to whose writings we have all learnt to look for clear philosophical views of the changes in naval warfare, "the good manœuvrers have not been less rare; those who are fairly good (*manœuvriers suffisants*) are become more common." We might even go further and say that in the Royal Navy at least the Officers who are really capable of perfect management of an ironclad under steam, are less numerous than those who had made a name for themselves as brilliant seaman for their skill in handling a ship under sail in former days.

There are good reasons for this. The inherent difficulty in managing a ship under sail in crowded harbours or narrow waters, almost forced upon any naval Officer who wished to be considered a competent seaman, a serious study of seamanship. The kettle has emasculated seamanship we are told, and in some senses it is true; it is certainly easier to manage a ship under ordinary circumstances under steam; and partly from this cause, partly from prejudice, it has come to be supposed that no study and but little experience is required for the manœuvres of an ironclad. The result has been pointed out by Jurien de la Gravière. When a new and improved weapon has displaced a less perfect one, this has been invariably the effect of the change. Thus, when the long bow was replaced by firearms in the days of

<sup>1</sup> *Vide* Discussion on United Service Institution's Naval Prize Essay, 1878.

Henry VIII, we have great regrets expressed at the discontinuance of the national practice with the favourite weapon; but it has been reserved to the present century to appreciate the necessity for perfecting our men in small-arm firing. No doubt it was considered that any one could hold a shooting-iron straight, it was so much easier than practising with the bow. This is or rather has been our case with regard to the management of steam ships, but we are beginning to awake from our delusion.

Our profession, to quote Jurien de la Gravière again, "was formerly "an instinct, it is now a science."

How many naval Officers care to know the number of degrees of helm that can be given to their ships; the tending of the screw to turn the ship unassisted by the rudder; the effect of turning the engines astern when the ship has head or stern way; the result of increasing or reducing speed on the circle described in turning; what the nature of the so-called circle is; what the reduction of speed by putting the helm hard over; what heel a helm hard over may be expected to give the ship; what the drift angle means; what is the time of completing a circle at different speeds, and its diameter? These and other questions are simple points of seamanship; yet an Officer who would think himself disgraced if he could not answer at once as to the lead of the lower studding-sail halyards, or a flying jib-guy, neither of which have been supplied to the ship in which he is serving, will acknowledge without a blush that he does not know if his screw is right or left handed, or how many blades it has. History repeats itself, and it was probably much the same with the young gallants of Henry VIII's Court.

If we turn to the writers on naval tactics since the days of steam we find the same idea. Thus Sir Howard Douglas, in his "Naval Warfare with Steam," whilst showing the capabilities of steam ships, assumes them to be able to make instantaneous movements, rectangular or diagonal, in obedience to their helms, ignoring the curves which must be described.

The Russian Admiral Boutakof, in his "Tactique Navale," published in 1862, criticizes the "remarkable book" of Sir Howard Douglas as "beginning by the branches instead of from the root." He says truly that "if only three ships are to navigate in company, "they must have rules based on the laws regulating their movements, "and the knowledge of these same laws is indisputably necessary to "each ship when she is even cruising alone." He claims to have derived his tactics by starting from "the root," that is, from the circle described by the ship.

Boutakof, however, in spite of his experience with, he tells us, 40 gunboats in the Archipelago of Finland, in 1861 and the two following years, which furnished him with "many new conceptions," seems to have uniformly worked on the principle of the circle of evolutions being an exact circle.

It is not a little amusing to find M. Lewal, a Capitaine de Vaisseau of the French Navy, in an elaborate and scientific work on naval evolutions, published in 1868, asking if Admiral Boutakof has dug



deep enough to find this root? and he answers, "Unfortunately, no! "he accepts purely and simply the circle as the point of departure, "and this is a capital error." For exercises and ordinary fleet evolutions this may be near enough, but when used for exemplifications of ramming tactics, his point of departure being inaccurate, none of his deductions can be accepted.

It was not till 1863 that some experiments on the turning of ships were made by Sir Cooper Key, when Captain of the Steam Reserve at Devonport, and about that time in the steam trials by the Steam Reserve Officers the turning powers of all ships were tried, and the times occupied in completing the half or whole circle registered. Recently these data have been supplied to Officers in the "ship's "books." In all these trials, however, it has been assumed that a circle has been described, and it is not till recently that the real path of the ship has been scientifically ascertained and noted, as in the case of the "Thunderer" trials in November, 1877.

To foreign Officers, and more especially to Admiral Bourgois and Captain Lewal of the French Navy, is due a critical and scientific examination of the problems connected with the turning of ships, to which the attention of Constructors and Officers of our own Navy has only recently been directed.

We propose here to give simply some of the conclusions arrived at, referring to the admirable paper "On the Turning Power of Ships"<sup>1</sup> by Mr. W. H. White, read at the United Service Institution in May last, and the subsequent discussion, for our facts. We could wish that the data for each ship were more fully given in compliance with what is now allowed to be requisite, for at present Mr. White tells us that the observations made by the Dockyard authorities include—

- (1.) A record of the time occupied in putting the helm over.
- (2.) A record of the times occupied in turning the half circle and full circle respectively.
- (3.) A measurement of the diameters of the "circles" in which a ship turns.

It will be evident from what we have said above that this will give but a very rough idea of the real course followed and distance run by the ship.

Let us, however, refer to the real path of the ship as explained by Mr. White.

The figure below will show the path of the ship to be a spiral, and according to Mr. White it was not till the ship had turned through  $360^{\circ}$  that the motion had become practically uniform. Admiral Bourgois puts this earlier, when the ship has turned  $90^{\circ}$  only.

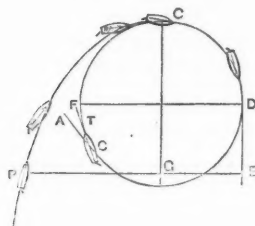
The drift angle is the angle between the tangent to the circle and the keel line of the ship. This drift angle is said to be the principal cause of the decrease of speed, and the rudder pressure has little to do with it. The following table gives the drift angle of the "Thunderer"<sup>2</sup>

<sup>1</sup> In Chapter XIV of his "Manual of Naval Architecture," Mr. White has also given a very good account of the principles ruling the steering of ships, but it was antecedent to the "Thunderer" experiments.

<sup>2</sup> Experiments made by "Inflexible" Committee in October, 1877, and published with Report, 1878.



FIG. 1.



The angle ACT is the drift angle.

with a constant helm angle, but with variations in the speed. Owing to the drift angle it is incorrect to assume that the ship has passed a quarter, half, or whole circle when the ship's head has turned through  $90^\circ$ ,  $180^\circ$ , or  $360^\circ$  respectively.

Speed on straight.	Drift angle.	Diameters of circles (feet).	
		Bow.	Stern.
8.2 knots.....	$5\frac{1}{2}^\circ$	1,350	1,410
9.4 ".....	$8\frac{1}{2}^\circ$	1,255	1,345
10.4 ".....	$9\frac{1}{4}^\circ$	1,240	1,340
11.14 ".....	$9\frac{1}{2}^\circ$	1,240	1,340

The following table shows the angle of heel due chiefly to centrifugal force. The greater heel of the French ships referred to is probably due to their being masted ships. This heel varies, according to Mr. White,

- (1.) Directly as the square of the speed of the ship.
- (2.) Inversely with the metacentric height.
- (3.) Inversely with the radius of the circle.

	Speed on straight.	Diameter of circle.	Draught.	Metacentric height.	Angle of heel.
	Knots.	Feet.	Feet.	Feet.	
"Thunderer" .... {	8.2	1,340	26.3	3.12 {	0.52
	9.4	1,250	26.1		1.11
	10.4	1,240	26.1		1.14
"Tourville" (French)	15	2,030	"	"	3.30
"Victorieux" "	10	1,290	"	"	2.0

From the next table the reduction in speed of the ship will be clearly shown; according to Mr. White, it may be taken at three lengths. In French experiments, according to Admiral Bourgois, the time of turning the first quadrant is uniformly less than for the remaining quadrants, which does not agree with the results in the case of the "Thunderer;" thus the "Suffren" turned the first 90° in 1' 33", against 1' 41" for the remaining quadrants. The time of putting the helm over is, however, not stated.

		Time.	At end of trial.	
			Speed of ship.	Angular velocity per second.
		Seconds.	Knots.	
To put helm over	31°.....	19	10 4	0 20
To turn ship's head	45°.....	56	9 25	1 18
" "	90°.....	89	8 3	1 18
" "	135°.....	123	7 75	1 15
" "	180°.....	159	7 5	1 12
" "	360°.....	320	7 14	1 6½

In referring to Fig. 1, we think it will be found that the definitions given by Captain Colomb, in the discussion on Mr. White's lecture, will meet all requirements, and naval Officers would soon become familiar with the terms used.

Thus, in the circle PCDF, P is the origin of ordinates on the spot when the helm is put hard down. Then we have the following elements:—

PE is the "tactical diameter," or the distance between the two courses when the original course is reversed.

C is the point at which a curve of 90° will have been described.

PG and CG will be the co-ordinates of that point.

CG will be the "advance," or the distance the ship will have advanced towards an object or a shore ahead.

PG will be the "transfer," which will be rather more than half the tactical diameter.

FD is the "final diameter."

Obviously the "advance" and "transfer" are of the highest importance to a ram, and they should be known for every ship in the Navy. The "tactical diameter" is also imperative, while the final diameter is rather interesting than useful.

The following table shows the tactical and final diameters of the "Thunderer" and "Victorieux":—

	Helm angle.	Speed on straight.	Diameters.	
			Tactical.	Final.
"Thunderer" .....	31	Knots.	Feet.	Feet.
		8.2	1,405	1,340
		9.4	1,320	1,250
"Victorieux" (French)....	33	10.4	1,320	1,240
		10.0	1,440	1,230

In the "Thunderer" the ship had advanced 1,000 feet in the direction of a straight course before her head had swung through  $90^\circ$ , and the transfer was 760 feet; when she had swung through  $180^\circ$  she was still 520 feet in advance of the spot (P) where her helm was put over, and the tactical diameter was found to be 1,320 feet, or considerably less than double the transfer.

The Mallory propeller is obviously beset with mechanical difficulties, as applied to large vessels, but it might be used with effect in torpedo-boats. It is a most ingenious arrangement for steering by the screw alone. Other special plans, such as bow rudders and bow screws, have been tried, but we need not discuss them, as they have not proved applicable to large vessels.

Of balanced rudders and auxiliary rudders, such as the Joessel plates fitted to the vessels of the "Comus" class, we need not say much. Any assistance in steering must be useful to a ram, but with steam steering gear, balanced rudders may be said to have lost their *raison d'être*, while no auxiliary rudders yet tried, have proved of much assistance. As Mr. White says, in summing up, "Twin screws furnish the best combination of economical propulsion with manœuvring which has yet been produced."

The "Thunderer," being a double screw ship, we have thought it useful to append the official trials of the "Lord Warden," which have been furnished us from the ship's book of that ship. She is a short ship, only 280 feet long, with an ordinary rudder, and hand steering gear with a left-handed four-bladed screw, and is reported one of the handiest ships in the Service. It will be seen that the diameter of her circle, under the most favourable conditions, was 4.1 times her length, at 5-knot speed, and at 12-knot speed, in 4.5 times her length, the times being 8' 53" and 3' 49" respectively. Admiral Bourgois quotes the "Marengo" (French), with a balanced rudder and Joessel plates, as turning in 335 metres, 3.09 times her own length, and our "Thunderer" as turning in  $3\frac{1}{2}$  times her own length, i.e., 1,010 feet, in 4' 25". We do not know where the Admiral gets his figures, but it will be seen that they are more favourable than the official ones given by Mr. White, both as to time and diameter of circle. His figures for the "Sultan" are still more favourable.

*Times and Diameters of Circle of Turning of Her Majesty's Ship "Lord Warden," at Plymouth, 13th September, 1867.*

Speed of ship.	Turning to	Angle of helm.	Time of circle.	Diameter of circle.	Remarks.
Knots.				Feet.	
5	Starboard .....	25	9 3	1,473	
5	Port .....	25	10 2	1,494	
5	Starboard .....	36	8 15	1,179	
5	Port .....	34	8 53	1,158	(2)
8	Starboard .....	25	6 16	1,569	
8	Port .....	25	6 40	1,560	
8	Starboard .....	36	5 48	1,428	
8	Port .....	36	5 50	1,242	
12	Starboard .....	25	5 01	1,668	
12	Port .....	25	5 07	1,527	
12	Starboard .....	36	4 36	1,668	
12	Port .....	36	3 49	1,257	(1)

From the above data we may assume the ordinary man-of-war to turn in  $4\frac{1}{2}$  times her own length at high speed, and a double screw ship in about 4 times her own length.

The most effective helm-angle has not hitherto received much attention, owing to the fact that few ships are capable of giving enough helm. From some experiments made by Sir Cooper Key, in the "Delight" gunboat, and by Admiral Halsted in the "Terror" floating battery, and with French rams, it would seem that up to  $40^\circ$  at least, increasing the helm-angle gives greater speed of turning and a smaller diameter of the circle.

The effect of a single screw on the steerage of a large ship is very marked; with well immersed screws the rule is that the bow turns towards that side to which the descending blade falls. Thus, a ship with a left-handed screw turns to port under the action of her screw alone, or must be steered with port helm to keep her on her course. With ships of light draught the contrary is the case.

In heavy ships with single screws, left-handed, the bow still turns to port when going astern, and far more decidedly than is generally admitted. The explanation of this apparent anomaly probably is that in going ahead, owing to the dead-water, the upper blade has more thrust than the lower, having less slip. In going astern, the lower blade has the most effect. We are, however, dealing with facts, and not theories. Men-of-war are not often forced to go astern for any distance, and the question has been overlooked, but if Officers will observe the conduct of Captains of screw packets, when going out of harbour, they will be astonished at the boldness with which steam is used going astern, on the assumption that she will turn in a certain direction, whichever way the wind may be. We are now quoting our own experience of the Shetland mail steamers, which go out of Granton Harbour stern first, at full speed, in perfect confidence that their bow

will go to starboard. Their screws are right-handed, and the helm is only used as an auxiliary.

In the table of the turning powers of the "Lord Warden," it will be seen that the quickest time, 3' 49", was in turning to port, as we should have supposed, and the least diameter of circle, 1,158 feet, was also turning to port, the diameter of the circle being also considerably less, and that much more when at slow than when proceeding at high speeds. The general tendency is, therefore, in favour of turning under starboard helm, but it is not as much so as might be expected, as we are informed that this ship carries one-half to three-quarters of a turn of port helm when at a speed of 8 or 9 knots.

Seamen generally will agree with Mr. White, when he says that<sup>1</sup> "all single screw steamers turn more quickly to one side than to the other," under similar helm angles, and it is important to the naval Officer to ascertain his ship's qualities in this respect.

Professor Osborne Reynolds, in reporting a Committee appointed by the British Association to investigate the effect "of propellers on the steering of steam vessels," states some interesting facts as the result of several experiments. He maintains that even before a vessel has lost her headway, if the engines are suddenly moved astern, the rudder has not only lost its effect in steering the ship when going ahead, but the ship will act and the rudder will affect her as if she had sternway. This, however, needs corroboration in our experience. He also states (and here we would ask for further experimental trials, as it is a matter of great importance) that "the distance required to bring a screw steamer to rest from full speed by the reversal of her engines, is independent, or nearly so, of the power of her engines, but depends upon the size and build of the ship, and is generally between four and six times the ship's length."

The work of M. Lewal, to which we have before alluded, gives minute attention to all these points, but as his work is 395 pages long, we cannot pretend to follow him. He generally agrees with the conclusions which we have quoted, except as to the time occupied in completing the circle under starboard or port helm, which he shows to be practically equal in French ships. His deductions from the trials of English ships bear out our previous assertion, though he is not aware of it, as he has fallen into the error of assuming English ships to have right-handed screws. His experience of the turning of a screw ship with sternway is very decided. In coming to, in the ironclad frigate the "Heroine," he states that he always turned to starboard, as he desired, in describing a curve of a very small diameter. He gives an illustration of the "energy and force" with which French ships turn to starboard under the influence of their screws moving astern, in the case of the "Massena," when coming to in Toulon, with a fresh breeze, in 1861, which is too long to be reproduced here, but if the facts are correctly stated, they show that the ship continued to turn her bow to starboard with sternway against her helm, and irrespective of the direction of the wind.

<sup>1</sup> "Manual of Naval Architecture."

Such then are some of the principles regulating the movement of screw steam ships. To acknowledge ignorance of them, preferring mere experience, or so-called practical judgment, is to prefer to fire a gun with a certain elevation, which experience, or general knowledge, enables one to guess, to a regular range table.

We should know our ship theoretically, and bring these theories into practice. If this were done, we are convinced that an extraordinary improvement in accuracy of manœuvring would result.

Captains, on commissioning ships, should be allowed the opportunity and enjoined to make an early trial of their ships under all possible circumstances, especially as regards the effect of the screw on the steering, both in going ahead and astern. They would also easily time the circle under starboard or port helm, and it could be measured in fine weather without much difficulty. It would, however, be more satisfactory if a table giving all the ordinary information on these points were drawn up by the Officers of the Steam Reserve, and given to a Captain on commissioning, or entered in the ship's books, which, as we have seen, give but meagre information on these points at present. We certainly have not yet considered the ship as a weapon which has limits to its powers, and requires a range table as much as the gun.

We will now take our ship into action. Our ship is a ram, with the armament of the "Hercules," and we will suppose her opponent to be identical in every respect. The speed and turning powers we will take as those of the "Thunderer," at 10.44 knots. Our tactics are ramming tactics, and the enemy is ready to meet us on our own ground.

In accordance with the maxim of La Gravière, the enemy does not fire his bow guns, and as yet we reserve our fire for an electric broadside. Both broadsides are ready, the guns prepared for ramming, and laid "Close alongside—abeam." Our object, on sighting the enemy, will be to steer towards him but keeping him a couple of points on the bow. As we near each other, the enemy, whom we will call B, heads a little more towards us, and our ship, A, continues her course. B being, however, desirous to ram, is willing to keep us a few points on the bow. At 2,000 yards' distance, we shall meet in three minutes, and the Captain of that ship, who shall not already thoroughly have considered his plan of attack, will find it rather late to improvise one. B, having read the works of Admiral Randolph and Captain Colomb, has assumed that the real tussle will begin after the ships have passed each other, and beyond keeping his ship's head inclined towards ours, and being prepared to ram on any broad sheer being made by A, he trusts to his guns for the first blow.

A proposes to attempt to ram from the first. He manœuvres so as to get B to steer an opposite course, whilst still keeping him 2 points or  $1\frac{1}{2}$  points on the bow. The wind being from B, and towards A, the latter has intended to fire one round from his bow gun to cover his intended movement; the gun is accordingly laid for 900 yards, and when the mast-head angle shows that distance, it is fired.

Instantly, the helm is put hard-astarboard. Covered by the smoke,

it is half a minute before B has discovered A's move, and that he is in imminent peril from his opponent's ram. If he hesitates and stands on, in one minute more A has crashed into his side, there is one heel, and all is over.

By Fig. 2 it will be seen that the case we have supposed is correctly stated by the "Thunderer" experiment. A wishes to strike B at right angles, and if B allows her to mask her intentions so as to make it possible, he will put his helm over when B bears  $17^\circ$  on his bow, and is at 7,580 feet distance. A has taken  $1\frac{1}{2}$  minutes (89" in experimental trial), to turn through  $90^\circ$ , she has advanced 1,000 feet, and made a transfer of 700 feet. In the same period, B has run 1,500 feet on a straight course, when the collision occurs at O. But it will be said B can easily frustrate this move. Let us see.

(1.) B slows his engines with the intention of being rather behind-hand at O, and so ramming A, for as Captain Colomb has long ago pointed out, the difference between rammer and rammees lies in a half a ship's length. This is probably B's new course. All now depends upon A's *coup d'œil*; the time has passed for angles and calculations, and he must watch narrowly B's movements. B has probably slowed too hurriedly, and A elects to cross his bows. It is rather risky, as 300 feet must be gained on B. If successful, A is within B's circle, he fires his starboard broadside, and can commence the action again with the advantage of speed and quick turning power in his favour. We would remark, that A at full speed can turn in  $5' 20''$ . B at 5 knots can probably turn in little less than 9'. Time is the true measure of distance in evolutions. If A considers it too dangerous to cross B's bows, he should right his helm and endeavour to give B an angular blow. Here he would have a great advantage in his speed, as even at an angle of  $25^\circ$  with the course of B, the blow would probably be sufficient to sink his opponent, and at a smaller angle fatal damage to rudder or screw might result.

(2.) If B elects to starboard her helm so as to turn towards A, the latter should cross B's bows, and immediately she is within the latter's circle make a second attempt to ram by suddenly reversing her helm.

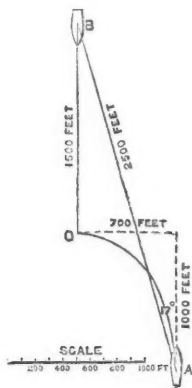
If B is proceeding at 8-knot speed, A at  $10\cdot44$  knots, A should turn when at 2,300 feet from B, and the angle should be  $19^\circ$  on the bow.

Diagrams can easily be made for other speeds. In any case A receives a broadside from B, but by his initiative he probably is himself aware before his opponent as to which side will be first engaged. From the above we have endeavoured to show the great advantage to be gained by assuming the offensive and acting on a pre-arranged plan. We would also point out the advantage to be gained by high speed in making your movements, and allowing no time for consideration to the enemy. Let us now suppose B to be too wary to allow A an advantage. He steadily keeps his bows towards A and continues at speed. We will not suppose that ships of equal strength will be Quixotic enough to ram each other bow-on, but we believe that they will go so close as

<sup>1</sup> Mr. Laughton, in his "Essay on Naval Tactics," shows that for a vessel of 8,000 tons, assuming 5,000 foot-tons to be the least effective blow, an angle of  $10^\circ$  would be effective at 12 knots, of  $29^\circ$  at 8 knots, and  $72^\circ$  at 4 knots.

to collide broadside to broadside, and it would probably be open to a skilful Captain with a sudden double movement of the helm to gain a slight advantage by damaging the enemy's screw or steering gear.

FIG. 2.



We will, however, suppose A and B to rub sides on equal terms. Both ships discharge their electric broadsides, A's guns being laid as nearly as possible for the water-line of the enemy. Strange to say neither ship is sunk, and although Whitehead torpedoes are discharged, either from want of room to dive or from the waves caused by the displacement of the water, they fail to act.

A has succeeded in running alongside B's port side, as he proposes to turn under his opponent's stern, and prefers starboard helm as more favourable for his left-handed screw.

The ships being clear of each other, A's orders are—"hard-astar-board, full speed ahead"—he turns across B's stern as in Fig 3.

If B turns to meet him, A has the advantage of starboard helm, and of being at least the width of B nearer to the centre of his circle than his opponent. He should accordingly be within B's circle, and have a chance of ramming.

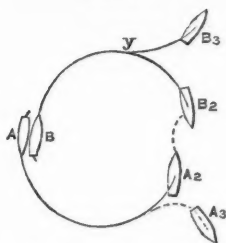
We have no exact data on which to draw the figure, the "Thunderer's" trial not furnishing us with information as to the path of a ship starting from rest; but from some trials in the "Lord Warden" the radius of the circle would be about 490 feet, and we have drawn the figure accordingly.

Whatever radius we assume A must be within B's circle, and have an advantage accordingly. If we give A the initiative of even half a minute, there is an extraordinary increase of chances in her favour.

We need scarcely point out that once fairly inside the enemy's circle A is at liberty to slow, stop, or even go astern, either to ram, to bring her broadside to bear, or to use her Whitehead torpedoes.



FIG. 3.



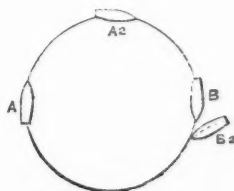
B, however, may elect to turn to port under starboard helm, and should she do so the action would recommence on equal terms, assuming both ships to have put their helms over together.

Let us turn once more to Fig. 3, and we will suppose B, finding that A will be within his circle, to starboard his helm at *y*, and when A arrives at *A<sub>2</sub>* B has reached *B<sub>3</sub>*. She escapes the ram certainly, but A is only 250 yards astern of him, and unless his stern fire is stronger than A's bow fire, or her speed is greater than A's, neither of which is the case from the terms of our problem, she must fall a victim to A. She cannot yaw to either side without being in danger of A's ram.

Here we see two things, the value of speed, which would enable B to increase her distance from A, and to begin the action again on equal terms, and the advantage of having a powerful stern fire. It would be most interesting to know how far a Whitehead could be depended upon if fired by B at A when in chase of him.

Should A and B agree to fight the action as an artillery and torpedo duel, as might not improbably prove to be the case after some ineffectual attempts at ramming, it would probably be found that they would ultimately be following each other round in a circle of 400 to 500 yards diameter. Once in this position, neither of them could use the ram except by stopping or turning astern, which would be extremely dangerous. See Fig. 4.

FIG. 4.



Let us suppose that B, wishing to ram, stops and goes astern; when at B she will probably be in the position of *B<sub>2</sub>* in  $1\frac{1}{2}$  minutes.<sup>1</sup> But

<sup>1</sup> Exact data as to the time and space required to bring a ship to rest under the

A in that time will have reached  $A_2$  with the ship well under command. She is inside  $B_2$ 's circle, and has every chance in her favour.

It has been proposed by several writers that a moderate speed of 7 to 8 knots is advisable when going into action. Let us, therefore, examine the advantages and disadvantages of moderate and extreme speed.

A we will suppose goes into action at a speed of 10·4 knots, B at  $7\frac{1}{2}$  or 8 knots.

A has the advantage of turning more quickly, but in a larger circle than B. The Captain of A has more time to consider and counteract B's movements, but he must well have weighed the result of his own celerity of motion beforehand, or his own speed will be against him, and his gun-fire will scarcely be so accurate as it would be at a lower speed. As, however, he only proposes to use his guns after a failure to ram this is of the less importance.

Referring again to the "Lord Warden" table we find that comparing the eighth and twelfth trials, both with starboard helm, the former at 8-knot and the latter at 12-knot speed, while the diameter of the circle was only 5 yards less at the lower speed, the time was 2' 1" more. If we take the 5-knot speed trial under otherwise similar conditions, we find that while the diameter of the circle is only reduced by 99 feet, or 33 yards, the time has increased from 3' 49" to 8' 53".

In Fig. 5, A is supposed to be at 12-knot speed, B at 8-knot speed; under equal speeds as we have seen, this case resolves itself into an artillery duel. In 3' 49" A has made a complete circuit, and is in her original place. B in 2' 55" has only gone round  $180^\circ$ , and in the 54" remaining she will have advanced less than 200 yards, having her stern and port quarter guns to reply to A's port bow and chase guns.

FIG. 5.



It is evident that A should now have B in his power. If it is thought that this is an extreme case, we answer that it is taken from official records, and that it is a fair exemplification of the necessity for retaining speed in a single ship action.

Let us now look at the advantage of better turning power possessed by B over A. If B, Fig. 3, is handier than A, she can frustrate A's manoeuvre; but if A should find that B will be inside her circle, and,

action of the screw is, as we have observed previously, much required. From some experiments which we have been able to make in a large ironclad, we believe our assumption to be not far from the truth.

shifting her helm, turn off to A<sub>3</sub>, if she has the advantage of speed, she can soon shake B off and recommence the action on equal terms.

From the above considerations the following conclusions may, we think, be drawn as regards ramming tactics in a duel between single ships:—

- (1.) A high speed, if not the highest speed, should be maintained.
- (2.) Speed is of even greater moment to a ram than handiness or turning power.
- (3.) A powerful stern fire is at least as important as powerful bow fire.

We have treated of the ram as the most important, indeed almost the sole weapon. True, under certain conditions, as we have admitted, an artillery duel might be substituted for it. A ship having the advantage of speed, but not in turning power, might prefer to trust to her guns, keeping a respectful distance from her antagonist; but in doing so she will have to make some sacrifices, and be forced occasionally to turn her stern to the enemy. A ship with less speed and inferior turning power to another, can only expect to be saved from being sunk by a lucky shot which cannot be admitted as a prime factor in the problem.

The advantages of boldly pursuing ramming tactics are well summed up in the pregnant words of Admiral Randolph:—

“A Captain who makes this form of attack on a single ship his main object makes the best defence against it, and woe betide the artillerist who, by losing sight of the danger, even for the sake of all the 81-ton guns he may carry, gives an adroit and resolute ram his desired opportunity:” to which we may add, “*Audaces fortuna favet.*”

“Two against one, what are the odds?” We cannot do better than put the question in the words of Admiral Randolph, though our answer would not be similar to his. We may suppose that except in the case of a decided superiority of the single ship she would avoid an action. But let us first consider the chances when all three ships are on an equality.

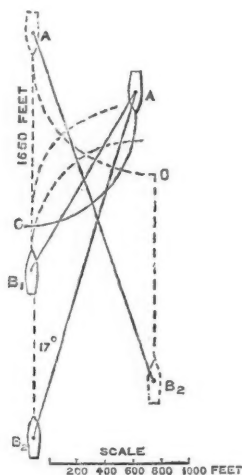
Obviously the single ship would endeavour to engage one adversary at a time. What formation would be the most likely to favour her in this object? Few will differ as to the answer. Line ahead of the two friends would be most to her advantage.

Let A be the single ship, B<sub>1</sub> and B<sub>2</sub> the two friends in line ahead at two cables apart. A steers so as to ram B<sub>2</sub>. If B<sub>1</sub> attempts to ram, she must, as we have seen, put her helm over at 900 yards distance; but she has not done this, intending to give A a broadside in passing, and wishing to capture, not to sink, her enemy. A, at the proper time having got within 500 yards of B<sub>1</sub>, swoops round upon B<sub>2</sub>. She gives and receives a broadside from B<sub>1</sub> in passing, but under cover of the smoke, she has a fair chance of ramming B<sub>2</sub>, and she has at all events shaken off B<sub>1</sub> for the time (see Fig. 6).

There is one advantage, and only one, in line ahead. There is little danger of the friends running into each other or getting in each other's way. They give each other the minimum of mutual support, but, on

the other hand, they are not hampered in their movements by those of their consort.

Fig. 6.



Echelon or bow-and-quarter line are neither of them much more satisfactory.

Let the B's be formed in bow-and-quarter line, B<sub>2</sub> being four points on B<sub>1</sub>'s quarters. In this case A's tactics would be to steer straight for B<sub>1</sub>, and when at 550 yards distance, being in a position to ram B<sub>2</sub>, she would put her helm over.

It is true that if B<sub>1</sub> put her helm hard aport at the same time or immediately after A, they would all then reach the collision point, O, at nearly the same time, B<sub>1</sub> and A colliding broadside to broadside, while the former would be in danger of being rammed by B<sub>2</sub>. (See Fig. 6, dotted lines.)

Should B<sub>1</sub> have failed to make out A's movement, which should be masked by gun-fire, the latter has a fair chance at B<sub>2</sub>, without interference from her consort. Broadside would of course have been exchanged with B<sub>1</sub> in passing.

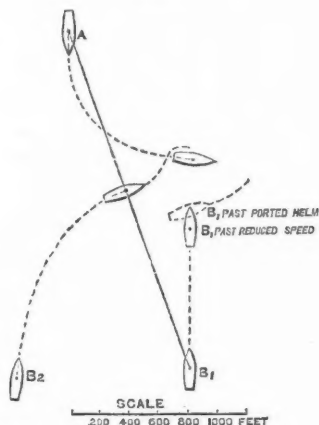
We have hitherto considered how not to do it, rather than the best formation for the two ships.

Let us now suppose the B's to be formed in line abreast. If at two cables' distance, as proposed by Admiral Randolph and Admiral Bourgois, who have considered this question scientifically, each ship can certainly offer some protection to the other, but want of space demands that they shall act together, and they would mutually endanger each other if they used opposite helms. The action of A in attacking one ship would be but little interfered with by the other.

## EXISTING TYPES OF VESSELS AND WEAPONS.

We would propose, therefore, that the B's should keep in line abreast, 4 cables apart, and endeavour to keep A between them. We have seen that A must attempt to ram when at 900 yards distance, assuming all the ships to be advancing at 10.4 knots. The tactics of the B's would be rather to place A between two fires than to ram. A, on the contrary, as we have hitherto supposed, must make a desperate effort to rid herself of one antagonist. She attempts to ram B<sub>1</sub> (Fig. 7). So soon as her intention is discovered, B<sub>1</sub>, by previous arrangement, reduces speed suddenly, while B<sub>2</sub>, with the helm aport, swoops down on A. B<sub>2</sub> takes care to be behind A, and either rams her on the quarter, which is possible if A reduces speed to avoid B<sub>1</sub>, or stations herself on her port quarter, making use of her bow guns. B<sub>1</sub>, when quite sure of A's passing ahead of him, unless he sees a good opportunity for ramming clear of B<sub>2</sub>, puts her helm aport and endeavours to place herself on A's starboard quarter. In this situation we may leave A a victim to her enemies.

FIG. 7.



Should A attempt to ram B<sub>2</sub>, the tactics of the B's would of course be reversed. Should A show no signs of ramming, the B's should be satisfied with giving her a broadside each at 200 yards 10° before the beam, and reversing the course instantly together in compliance with signal from the senior Officer.

### *Two to Two or Three to Two.*

In two to two we cannot follow the tactics of two to one. The ships must work together, or there is danger of two combining against one.

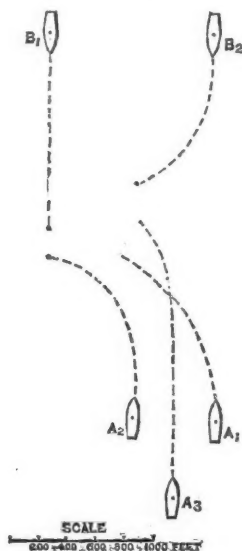
It therefore appears that they must keep within a short distance of each other, say one cable. The endeavour should be to keep the

enemy's outer opposing ship  $1\frac{3}{4}$  points to 2 points on the bow of  $A_1$ , Fig. 8. When at about 1,000 yards distance, both ships should circle round to attack the most distant of their opponents, combining on  $B_1$ . The  $B$ 's being supposed to be 2 cables apart,  $B_2$  would scarcely be able to interfere with  $A_1$ , and if the ramming attack failed,  $B_1$  would be placed between two fires, and  $B_2$  would have received an uncomfortable broadside from  $A_1$  as the latter swept across his bows.

In three ships against two we would advocate the third ship being kept in reserve. Two ships in line abreast as before, the third being between the two leaders, and 2 cables' length from either (see Fig. 9), the rôle of  $A_3$  being to occupy the attention of the ship not attacked by his consorts and endeavour to ram him, if possible.

It will be seen that we believe line abreast to afford better mutual protection than line ahead and échelon for two ships. Any échelon partakes of the weakness of line ahead, whilst line abreast has the objection of masking each other's fire.

[Figs. 8, 9.



Admiral Randolph, in one of his admirable instances of a naval fight, has acknowledged that under some circumstances line abreast has an advantage over even his very open échelon, whilst Admiral Bourgois,<sup>1</sup> who advocates the line abreast *pur et simple* on all occasions, points out that in all bow-and-quarter lines the leading ship can only

<sup>1</sup> *Revue Maritime et Coloniale*, 1876.

afford protection to his friend when the latter is at an angle of 4 points on his quarter, and that no mutual protection can be afforded.

It by no means holds good, however, in our opinion, as a corollary, that line abreast is the best formation possible for a fleet, because we believe it to be the best for two ships. We are no theorists, and we do not pretend to have found an immutable law.

Circumstances alter cases, and if it is expedient to compare great things with small, there is no greater error than to seize upon a so-called principle or rule, and by false analogy to endeavour to apply it where it has no real bearing.

#### CHAPTER III.—*Evolutions—Fleet Organization—The Signal Book.*

Evolutions are not tactics, though they may form the basis on which tactics are founded. Evolutions are simply fleet drill, and the Signal Book is the drill book. Whether it is a manual of naval manœuvres, as its transcript, commonly termed "the Manual," would lead one to suppose, we shall inquire hereafter.

We propose now to consider whether the evolutions and manœuvres, as carried out in accordance with the Signal Book, are based on a sure foundation, whether Officers instructed in the evolutions as now performed in our fleets are thereby rendered proficient in manœuvres which may be utilized in real combat, or if they are complicated evolutions savouring more of the barrack yard and pipeclay than of more important considerations.

We do not wish to dispute the importance of even a drill sergeant's knowledge. This, however, in a ship should be possessed by each individual Captain, but we ask that each evolution shall be ordered to be carried out in the most thoroughly effective manner; that it should, both as regards time and precision, be all that can be desired. Further, that it should be simple, avoiding any unnecessary complication of words or ambiguity of expression.

First, then, let us look at the principles underlying all our fleet evolutions.

The first principle is that of rectangular movements, to be used in ordinary cases of change of formation of a fleet once formed in any order. So strongly is this view held by those in authority that the famous Admiralty Minute on the loss of the "Vanguard" censured the Admiral for not having formed two columns by such a change of order, instead of making the signal for "two columns," leaving the ships to get into station as they best could.

It is remarkable that Admiral Comte Bouet-Willaumez, of the French Navy, who claims to have originated the rectangular movements authorized by the French tactics of 1861, should have reconsidered his opinion, and in accordance with his views, the French system was again altered, all rectangular movements being eliminated as unsuitable for rams.

His reasons for such a change of front having considerable interest, we give them in his own words:<sup>1</sup>—"What I propose to-day . . . .

<sup>1</sup> "Tactique Supplémentaire." Published by Ed. *Revue Maritime et Coloniale*, 1867.

"is to substitute for flank movements evolutions in oblique lines, which  
 "are more appropriate to the strength of the ships, viz., to their bows,  
 "than to their weakness, viz., the side, pierced with ports, and on  
 "which a blow from the ram, striking normally, might cause a  
 "disaster."<sup>1</sup> He further remarks that the chances of collision by the  
 oblique movements are smaller.

Here we must agree that the French Admiral has shown a proper  
 conception in looking to evolutions as applicable to fighting tactics,  
 though his logic may have carried him too far.

In contrast to our system, the French plan of Bouet-Willamez is  
 here produced, and we cannot help admiring its conciseness, its simpli-  
 city, and apparent completeness. These evolutions were all performed  
 in turn by the evolutionary squadrons, under Bouet-Willamez, in  
 1865—1866, consisting of 6 and 9 ships.

Total number of evolutions, 20.

From line ahead—

- $$4 \left\{ \begin{array}{l} \text{Form line abreast.} \\ \text{Line ahead in pelotons.} \\ \text{Line abreast in pelotons.} \\ \text{Two columns.} \end{array} \right.$$

From line abreast—

- $$4 \left\{ \begin{array}{l} \text{Form line ahead.} \\ \text{Form line by pelotons.} \\ \text{Form line abreast by pelotons.} \\ \text{Form two columns.} \end{array} \right.$$

From line ahead in pelotons—

- $$4 \left\{ \begin{array}{l} \text{Form line ahead.} \\ \text{Form line abreast.} \\ \text{Form line abreast by pelotons.} \\ \text{Form two columns.} \end{array} \right.$$

From line abreast by pelotons—

- $$4 \left\{ \begin{array}{l} \text{Form line ahead.} \\ \text{Form line abreast.} \\ \text{Form line ahead by pelotons.} \\ \text{Form two columns.} \end{array} \right.$$

From order of sailing in two columns—

- $$4 \left\{ \begin{array}{l} \text{Form line ahead.} \\ \text{Form line abreast.} \\ \text{Form line ahead by pelotons.} \\ \text{Form line abreast by pelotons.} \end{array} \right.$$

This the French Admiral considered as all that was needed; he  
 gives the times of performing the different evolutions, which certainly  
 seem fairly good; but it must be recollected that the fleet was not  
 large, and that it had had plenty of practice.

<sup>1</sup> A translation was made by Admiral Phillimore in 1862.



The pelotons referred to were in the form of an equilateral triangle. It is worthy of remark, that Bouet-Willamez was the originator of the peloton, not for fighting purposes, but as "an habitual order for navigation," so as to take the place of lines of ships in each other's water, "an order compromising for steam ships, especially at night."

The equilateral triangular peloton, as a "*peloton de combat*," became, however, subsequently usual in the French Navy, and is so referred to by Lewal and others.

As regards the method of performing the above evolutions, the only instruction given is, to gain your new station as soon as possible "*chasser son poste*."

That French naval Officers, from the time of the Prince de Joinville to the present day, have been adepts at station keeping, and we may presume at performing evolutions, is universally admitted; but unless their qualities in these respects are really far superior to those of our own Officers, it is difficult to believe that any exact or rapid performance of evolutions is possible under such free and easy regulations as the above.

That all is not entirely satisfactory in the French Navy the following extract from M. Lewal's work will show, but it is fair to admit that the writer is impressing upon his brother Officers the necessity for an exact calculation beforehand of the course to be followed by them in all cases, and he probably exaggerates the mistakes made. Making every allowance, however, his words are very decided:

In speaking "of Exercises," he says:—"In this period of doubt and indecision of minds, no one has established principles nor any fixed plan of manœuvre or evolution; every Captain must suspect his neighbour and is preoccupied by the fear of being run into or running into others. There is no decision, no precision, in manœuvres. Every one wishes to know what his neighbour will do; the helm is not put over instantaneously, nor rapidly, nor at once at the required angle, as it should be. As the result of these hesitations, simultaneous movements cannot succeed, &c."

Now this we must admit is what we should expect to occur, nay, what does occur, in a British squadron, where each Captain is left to his own judgment to reach his station. It must be remembered that one ship badly handled may throw a whole line out, and it is, in our opinion, wise to prescribe as closely as possible to each Captain the course to be followed. This is what is done by our code of evolutions. No Admiral would attempt an evolutionary change of formation when in action with the enemy, and this objection is of no weight in practice.

Our principles, then, of rectangular movements which allow of changes of formation being made without variation of speed, are, we hold, correct.

Let us now examine them further in detail. We find, further, that while the principle of rectangular movements is maintained throughout the evolutionary code, and the distance apart of columns (we use the word in its Signal-Book sense) is so ordered as to make the transition from any one formation to another possible by this system,

abundant elasticity has been left. Thus, where the change of formation can be effected more expeditiously by a leading or wing division or ship continuing its course, the option on this point is left to the Admiral; we find, too, that the simple signals directing a certain formation to be taken up, but without indicating how the ships are to carry out the evolution, are retained to be used when the fleet is either formed or not in any order, but chiefly, as we have seen from the "Vanguard" circular, intended to be used in the latter case. Still the option is left; and it would be of great advantage if the Admiral of one of our evolutionary squadrons were to perform a certain number of simple changes of formation by the rectangular, and what we may call the "happy-go-lucky" plan alternately, timing each, and reporting as to the accuracy with which each of them enabled the evolution to be performed, and the time occupied, though we can have little doubt as to the result. The difference of principle is happily explained in the "Manual," pages 24—30. The author points out how the advantages of the rectangular movement increase with the speed of the fleet, and sums up by showing that—"Only when there is "reason for keeping the leader on the right, and an objection to "taking ground to the right, or a reason for keeping the leader on "the left, and an objection to taking ground to the left, can the "method, Fig. 2 (leaving ships to get into their stations as they best "can) be admissible as a rival to the rectangular movement."

The authors of the numerous recent editions of the Signal Book have further shown themselves by no means niggard of signals; there has been little attempt at logical completeness, and conciseness has been sacrificed to clearness. It would be easy to dispense with nearly half the signals by adding a note, but the authors have wisely discarded notes, so that each signal stands out clearly and distinctly by itself. Thus we have numerous signals, each conveying its own meaning rather than exact classifications.

We are not, however, now criticizing the Signal Book, but examining the system of evolutions or drill in use in the fleet. This we have seen leaves little to be desired. Let us now examine the requisites for enabling evolutions to be accurately performed. The first necessity is naturally that stations shall be accurately kept. If ships are not in good station, rectangular manœuvres are impossible without serious danger.

In our evolutionary fleets all ships are now furnished with a table of coefficients of speed or comparative number of revolutions. It has not yet, however, been considered necessary that coefficients of helm or comparative helm angles should be ascertained. We cannot help thinking that this is equally necessary with the table of revolutions. Both can fairly be ascertained by ordinary observation, both require considerable allowances to be made in practice; but few Officers will now hold that the former is useless, and we believe the latter to be equally important.

In computing the requisite number of revolutions, allowances must be made for the previous speed of the ship and the special circumstances of the case, such as a bluff-bowed ship requiring more power

to press her against a head sea, and other causes. In helm angles, likewise, similar allowances have to be made, but the necessity for some firm basis from which to start is apparent.

The writer, who is one of the "fortunate Officers" alluded to by Admiral Randolph, who has served in recent evolutionary fleets, has observed that when the Admiral of a fleet was himself in a long, unhandy ship, he never seemed to remark on her steering, and "all went merry as a marriage bell;" when the contrary was the case, there were considerable searchings and inquiries as to the unwieldy length of the defaulter; and we have had a recent instance in the "Alexandra" and "Achilles" collision, showing that the bad steering of the latter, although necessarily known, was not sufficiently appreciated. We hold, therefore, that each ship should have a table of helm angles corresponding with the hard over and other angles of helm of the longest ship in the fleet. Assuming this hard over to be  $32^{\circ}$ , half helm should be  $25^{\circ}$ , and easy helm  $15^{\circ}$ . Each ship should have a table of helm angles corresponding with those here referred to. Whilst on the subject of helm angles, it may be worth while to refer to a practical question of great importance, showing the extreme difficulty of accurately manœuvring ships of different sizes and qualities in the same fleet.

It must often have been observed how a short, handy ship gains upon a long ship in turning, which is probably due to the decreased helm angle. M. Lewal has shown from some experiences of the "Solferino" and "Provence," at 9-knot speed, the latter with  $24^{\circ}$  of helm had her speed reduced to 7.7 knots; while the "Solferino," with  $34^{\circ}$  of helm, only went 6.4 during the curve.

Every ship, too, should have a dummy compass in some convenient place on the bridge, where relative bearings can be observed. We have also found a board, marked out in squares of 2 cables' lengths, with leader ships, very useful for block drill; and we would recommend a deviation table, something in the nature of Smith's table, but with the point to be steered by standard compass opposite the true magnetic course signalled, so that no calculation of deviations may be requisite. In general, any helps which may enable Officers to give their whole thought to the special facts which must complicate every evolution are of value, and we have accordingly indicated a few. The steering signals and speed signals now in general use are all of great assistance, though it is probable that they would have been looked upon as unnecessary complications twenty years since.

The ship being in station, there should be no hesitation as to the helm, which should at once be put over to the proper angle on the signal or preparative being hauled down. Here we see the beauty of the rectangular movement. Evolutions based on these principles leave no room for hesitation, a decided course must be at once adopted; and while, as we have seen, they are admirable in themselves, they have the indirect advantage of inculcating the practice of decision, which is of immense importance to those whose duty it is to learn, in the words of Jurien de la Gravière, to "navigate in a limited space" masses of 6,000 or 7,000 tons, which cannot come into collision

"without mutually smashing each other." After all, and theories apart, what is wanted is nerve and a good digestion.

With these, a knowledge of the Signal Book, the ship in station, orders given decisively and promptly carried out, all evolutions requisite, and which the Signal Book allows, can be performed with perfect confidence and without danger.

They are not, as we have endeavoured to show, unnecessarily complicated, and they are certainly well adapted to keep a fleet under command in readiness for the more distinctly tactical formations which would be required in action.

It would be unnecessary to spend much time in examining the question of fleet organization but for the vexed question of groups.

In the ordinary organization by divisions, we find that the fleet may be divided into "one, two, three, or more divisions at the discretion of the Admiral in command according to the number of ships present, and the circumstances of the service. Each division is to be divided into two subdivisions." On this we need only remark that an Admiral in war-time would have to give much consideration to the special nature of his ships, as it would be obviously inadmissible to place them entirely in accordance with the seniority of the Captains, as is now usually done, the ships being mixed up regardless of their powers; thus we may have a division consisting of the "Hotspur," "Achilles," "Black Prince," and "Research," and another of the "Minotaur," "Penelope," "Thunderer," and "Warrior." It is evident that the Admiral will find great difficulty in adjusting the reasonable claims of different Officers whilst placing his ships in a suitable fighting formation, and we can only suggest that these subjects should receive some consideration from the Admiralty in dispensing their patronage.

We do not suppose that modern fleets will ever be very large, so we will take 12, 15, and 18 ships as probable numbers. Should the Admiral think it advisable to fight his ships in groups of 2, he could divide his 12 ships into 3 divisions, and 6 subdivisions. Should he prefer groups of 3, he will divide his fleet into 2 divisions and 4 subdivisions.

Similarly with 18 ships he would have 2 divisions with 9 subdivisions, or 3 divisions with 6 subdivisions. With 15 ships he would have a large choice, viz., 2 divisions, and 4 subdivisions, or 3 divisions and 6 subdivisions.

It is scarcely necessary to point out that the first question which the Admiral would propose to himself would be, what should be his squadron or group unit. The answer would probably be that the unit should be larger in proportion to the size of the fleet, thus while with 6 or 8 ships it might be preferred to fight in pairs, with 12 to 18 ships, 3 would be a more reasonable unit, while with a large fleet, 4 or even 5 ships should form the group unit. This we hold to be the right principle; with 15 ships, for instance, we should divide the fleet into 3 divisions, and 6 subdivisions, consisting of 3 and 2 ships alternately.

It will be seen that whilst we speak of groups, we do not consider a group as essentially 3 ships in a scalene triangle as usually understood

in the Navy at the present time. Such a hard and fast rule is, we hold, unreasonable and inconvenient. There is no special virtue in the number three, and there is no extraordinary strength of formation in the scalene triangle formation to which we will revert presently.

The Signal Book and Manual, which is now, we regret to observe, a mere transcript of the former with a few extra notes and observations, distinctly lays down that there must be two systems. "One system is "termed fleet-organization, and the other group-organization." Now, with every deference to the experienced Officers who have come to this conclusion, we cannot but consider that this is entirely unnecessary, and that the subdivision should be the group or unit of organization.

It would almost seem as if two hands had been at work, one insisting on the group as consisting of 3 ships in scalene triangle formation, and the other determined to show the folly of this by drawing up the above instruction.

It is certain that from our point of view, and from the point of view in which the question has been regarded in the French Navy, the double system is a new complication marring the simplicity of the fleet-organization, and resting only on a sort of fetishism that a group must necessarily consist of 3 ships. Now the virtue of a group consists in our opinion in the breaking up a fleet into a larger number of groups or pelotons of ships, and thus rendering it more mobile. With the greater flexibility and handiness of a steam-fleet this became necessary, and it answers to the development of skirmishing movements in the sister service. In former days, when once the fleet bore down upon the enemy the Signal Book was closed: it was almost certain that after an engagement was in progress, ships would be disabled, and beyond a general muster of the least damaged ships to protect those which had been most ill-treated, little manœuvring was possible or requisite. Now, on the contrary, in bearing down on the enemy, changes of course involving possibly changes of formation may be required, and while the speed is high, smoke will in many cases obscure the view, rendering long lines of ships impracticable, and a clear view of Admirals difficult.

When later on in the engagement the ranks are broken, although La Gravière may be quoted as saying "the book of signals can without "fear be shut, the responsibility of Captains commences," we believe that rallying points will be required, and that the leaders of groups will form such rallying points. From this point of view 3 ships certainly form a reasonable number, and this is we suppose what Mr. Laughton refers to when he speaks of the plan of groups having been that under which the English opposed the Spanish Armada. To owe special allegiance to a particular senior Officer who can easily be kept in view, to act with him and to support him on all occasions as a brigadier, is, we hold, a good fighting principle, and by no means tending to disintegration of the fleet as has been held by high authority. If we compare it with the army, the ship is the battalion, the group the brigade, the division the division, and the fleet the "corps d'armée." A very large fleet would be divided into more than one fleet as proposed by Captain Fleetwood Pellew in his book on fleet manœuvring, published in 1868. Thus we have our organization complete.

But we cannot leave the question of groups without dealing with what should, we hold, be one of their intrinsic virtues. The idea is that the group of three acts as a single ship, that Nos. 2 and 3 should follow No. 1 as they best can (it is somewhat vague, certainly, but no further instructions have ever been given), and that, whatever changes or evolutions may be performed, No. 1 is at the head of his group, acting as leader, while Nos. 2 and 3 are his supports. The theory sounds plausible, but we have gradually lost this principle from the difficulty in practice of manœuvring a group as one ship; and now, in the new Manual, at least, we have it authoritatively stated that, when ships are in "group formation," any signal which entails "an alteration of course is to be acted on by all the ships in each group together, unless otherwise ordered, and group formation is not to be resumed till the signal to that effect is made."

Now, here we have the original principle of the group ignored—Hamlet, with the principal part omitted. It has all "eventuated" in our old friend, "alter course together."

A few years ago, in the desire to develop the group principle, we elaborated a scheme for group evolutions which was sent to the Admiralty, and has since probably occupied a convenient pigeon-hole, most likely as good a fate as it deserved. We only allude to it now to mention what we then endeavoured to prove, viz., that rules could be formulated for the conduct of each ship in the group in making a change of course, our principle being that No. 1 should always alter to the new course immediately, the other ships getting into their stations by certain prescribed movements. With an alteration of more than 5 points, the whole would turn to the new course together, Nos. 2 and 3 changing places and numbers. In carrying out a change of formation, the fleet being organized in groups, it is obvious that it is advisable for every ship in the group to turn together, so as to be again in a correct group when the evolution is completed.

We are glad to find that the Manual, in reversing groups 16 points to port or to starboard, rejects the tempting heresy of changing 1 and 3, and makes only 2 and 3 change, the leader remaining No. 1, as we proposed.

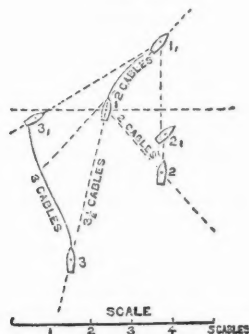
In the Channel Fleet, under Lord John Hay, a most elaborate system of group movements has been recently adopted, the experience so gained being of the highest value, as showing what can be done under different circumstances, and on different principles, with groups. Both principles of movement, viz., the altering course together and what is, as we have endeavoured to show, the more correct one of the group moving as a single ship, were in use. Groups to starboard, groups to port; 2 and 3 changing, 1 and 3 changing, &c. To prevent inextricable confusion, the plan was adopted of always retaining the original numbers, and hoisting C 2, 3, C 1, 2, &c., when groups had to be re-formed, C being the temporary leader, the second flag showing the temporary No. 2, and the third showing the temporary 3.

There is no denying the ingenuity of the above schemes, and Captains and Signal Officers had need of all their intelligence to carry out the movements, though we were rather reminded of the

old "Excellent" puzzle of "man both sides," "change rounds," "change watches," &c., and the final poser, "Where are you now, No. 1?" would have been very apposite in many cases. Still, the evolutions as drill were undeniably useful, and in altering course as a group, the Admiral's instruction was sound; the helm he said was to be used to get on the proper bearing from the leader; the speed had to be regulated to maintain the distance. The requisite alteration of speed and proper helm angle might, we think, have been explicitly laid down, but this was not attempted. In any case, a considerable reserve of speed must be at hand in group movements.

The subject of the proper way to move a group is in itself a study, and we have no space to do more than give a sketch of the different theoretical principles which should guide us. Rejecting the "alter course together" as inapplicable to groups, we can obviously alter course either by the wing ship as a pivot or by the leader of the group. In the former case the rules as to helm and speed would be simpler, but the evolution would take longer. By the following figure it will be seen that rules could be given for altering course by pivoting round the group leader; the case we have taken supposes the group to be proceeding at 8-knot speed, and the alteration of course to be 4 points. The rule should be, No. 1 to alter course at once, under half helm ( $25^\circ$ ), 2 would do the same with extreme helm ( $32^\circ$ ), while 3 would stand on and alter course under small helm when getting into her leader's wake. If we now assume the leaders not to reduce speed, No. 1 will have probably advanced 2 cables in  $1\frac{1}{3}$  minutes, before getting on her new course, the loss of time due to decreased speed while making the circle; this, however, will be made with her moderate helm, but it will serve to assist No. 3. No. 2, in the same time, should only go one cable, and she should accordingly stop with her helm hard over till nearly in her station, and then resume her original speed. No. 3, on the contrary, has to go three cables while No. 2 goes two and No. 1 goes one. She should therefore, theoretically, sheer a little to port, and then turn to starboard under

FIG. 10.





half helm, and she would require to go at 12-knot speed. Practically, an increase of speed to that amount, even in a very fast ship, is unattainable; the direction, therefore, to No. 3 should be to proceed on her former course at full speed, and to turn gradually to her new course when getting in the wake of No. 1. The directions for each ship might be accurately given in the Signal Book, and if groups are to be retained, directions for alterations of course should be given in detail, as below, for each change of course of 4 points:—

Altering course less than 4 points, to be given in Signal Book.

Ditto 4 points and less than 8 points, as above proposed.

Ditto 8 points and less than 12, to be given.

We must spare a short space for the examination of the tactical value to be attached to the scalene triangle group formation.

It has come to us from such high authority, that of Admiral Sir Thomas Symonds and the late Commodore Goodenough, and it is supported by Sir G. Hornby, and such a general consensus of naval Officers that we should like to speak of it with all respect, yet, upon a careful consideration of its merits, we are forced to reject it. Even as regards authority, there is a good deal to be said against it; Bouet-Willamez, as we have seen, never proposed it as a fighting formation. Admiral Bourgois distinctly objects to all "*formes triangulaires*," the leading ships being, in his opinion, unsupported. In our own Navy, Admiral Randolph ignores the recognised group as a tactical formation, and Captain Colomb, who has given more study to naval tactics than any other Officer, is unfavourable to it.

In our view, in the form adopted in our Navy, it is an attempt to create a formation combining some advantages of the ram and the broadside fire, and as such it is a failure. It is certainly difficult to see why, if the 4-point position, for instance, is the best for supporting the leader against a ram attack, the protection is only to be given on one side or, *vice versa*, if the position of No. 3 is considered the most advantageous. The French "*peloton d'attaque*" is certainly more logical, and we prefer it on the whole as a better fighting formation, and it is certainly easier to keep accurately.

In this wise we do not see any great advantage in the group. The best form for a triangular group would be, we believe, the French peloton reversed, Nos. 1 and 2 being abeam of each other, and No. 3 forming the apex of an isosceles triangle between them. Where the Nos. 3 could be formed entirely of rams, the latter being half as numerous as the other ships composing the fleet, we believe the above to be a good tactical formation, but it discards altogether the idea of the wedge, which has generally been associated with the triangular group. In dealing with evolutions, fleet organization, and the group system, we necessarily had occasion to refer frequently to the Signal Book, but the Signal Book, as our code of evolutions and tactics, demands special consideration. We have seen that it is an efficient drill book, but how much further does it go in the higher questions of fighting requirements? Before, however, touching on this important point, a few remarks on the definitions and other principles embodied in the Signal Book may not be considered superfluous. Of the flags



and general method of signalling by day, and the flashing signals by night, it is unnecessary to say much. The latter, by their intrinsic merit, have won universal acceptance in the Service of recent years, while the former have been the same since the beginning of the century, all well-meaning reformers having retired discomfited with their schemes of radical change. It is among facts not generally known, that our flags, with but one or two exceptions, are made on the principle of dark and light colours, and it would be almost equally easy to decipher them, if all red, black, and blue colours, were black, and all yellow and white, white.

The story of the Officer whose knowledge of flags was limited, reading a "hoist" as "the five of clubs, the ace of spades, and the chequer board," shows that he at least had not discovered the necessity for colour. We will, nevertheless, point to two flags where improvement might be made, the C and D; the former especially, when old, wants colour, and should be relieved by a dark-coloured St. Andrew's and George's Cross, the latter or pilot jack might have a broad red border instead of the white one now used.

If we turn to the definitions, we see that a great improvement has taken place in recent editions of the Signal Book, the terms, "guide of a fleet," "guide of a column," and others, being comparatively new. The term "columns" is also now used to mean "Any number of ships in a distinct body, whether in line ahead, line abreast, or otherwise." The word has been objected to with justice, as having a forced meaning, but at least it describes clearly a body of ships in any formation, and this was previously much required.

We have certainly much improved since a distinguished Flag Officer some twenty years ago, who had had some hand in remodelling the Signal Book, could point to such a definition as the following, which has rested in our memory on account of its very vagueness and ambiguity. "The formation or disposition of a fleet is termed its order." In other ways we see decided improvements in the new Manual. In the Signal Book now about to be superseded, it required a practised hand to find the requisite articles in the instructions; thus we had:—

- (1.) Instructions for the organization of a fleet, XVIII articles.
- (2.) Instructions for the conduct of a fleet, XII articles.
- (3.) Action—General Instructions, X articles.
- (4.) Evolutionary—General Instructions, XV articles.
- (5.) Evolutionary—Forming or Changing Orders, VI articles.

Or a total of 61 articles scattered somewhat promiscuously about the book.

It was certainly an improvement to reduce these instructions for guidance to two headings in the new Manual; viz. :—

Instructions for the organization of a fleet, XXIII articles.

Instructions for the conduct of a fleet, XLVIII articles; or 71 altogether.

We find several minor improvements in the new Manual, especially in the "manner of using distinguishing flags," and in the command "pass signals," which were certainly faulty previously; but there is one article, the "bearings and distances" of ships in column, which

are now directed to be taken from the Commander of the column in whatever formation the ships may be in, against which we may protest, as the Commander of the column may be in the rear of the line, or he may be the outer ship in a change of course involving a wheel; this is clearly a mistake, and we prefer the previous instructions on this point in the older book.

In some respects, we observe that old articles now obsolete in their application to steam ships are still retained, thus Article XXIV in "Instructions for the conduct of a fleet," which speaks of a ship "neglecting to put in stays, or to wear, &c," is still our only warrant for passing a ship which fails from whatever cause to keep her station. Something less vague is obviously requisite. Most Captains have experienced the difficulty of "combining the information" gained from the two articles, one of which enjoins them to be 2 cables from their next ahead, and the other directs them to take their position from the leader of the column, especially should the ship "next ahead" keep indifferent station.

On this subject, we may remark on the much greater difficulty of keeping anything like good station when in "open" than in "close order," and now that "close order" is specially ordered in a fog, it is abundantly clear that it might and should be maintained under all circumstances, by night and by day, except in very bad weather, when ships are lying to, and not under command.

We are reluctant to push our remarks upon the Signal Book much further, but it is impossible to deal with evolutions or tactics without showing how in our estimate it may be improved. We feel bound, therefore, to point out the weakness of the technical definitions of formations. Thus, when "columns of subdivisions in line ahead" are formed, the diagram attached to the signal shows that the subdivisions themselves are ahead and astern of each other, no other distribution of "columns of subdivision in line abreast" being apparently contemplated. Similarly in forming "columns of subdivisions in line ahead," it appears that the subdivisions themselves are always supposed to be abeam of each other. If these columns of subdivisions, whilst still in "line abreast" or in "line ahead," were to be ranged in bow and quarter line, the situation would be unknown to the Signal Book, and we fail to explain our meaning in technical language. We would, therefore, suggest the following definitions:—

"Columns in line ahead are said to be in 'direct order' when the lines are abeam of each other, the first or leading division being on the starboard side. Columns in line abreast are said to be in 'direct order' when the lines are astern of each other, the first division being the leading division.

"Columns in line ahead are said to be in 'direct oblique order to the right' when the lines are ranged in bow and quarter line, the first or leading division being ahead and to the right.

"Columns in line ahead are said to be in 'direct oblique order to the left' when the lines are ranged in bow and quarter line, the first or leading division being ahead and to the left."

Similar definitions may be given for lines abreast in "oblique order." "Reverse order" to be the reverse of "direct order."

With these definitions we might considerably increase the number of tactical formations in use with advantage. At present the Signal Book does not acknowledge an échelon of columns of divisions, or subdivisions, either in line ahead or line abreast, which is, we think, a decided omission.

We have hitherto remarked on the Signal Book viewed only as a book for drills and evolutions, but as it is also our only code of tactics it is necessary to examine it in that light. We may premise that we are speaking of the old Signal Book now about to be superseded, and that many of the omissions to which we shall have to refer may not improbably have been supplied in the new books shortly to be issued to the fleet. They have been very properly omitted altogether in the new "Manual."

Alluding, then, solely to the old Signal Book, we ask if we are right in supposing that all these signals, evolutions, and manœuvres are intended as a groundwork for tactics, and if so, where are the tactics? Admiral Randolph asks the same question; he says, pointedly, "But are even the evolutions prescribed for the squadrons sufficient? If battle is their object, where are their formations or plans of attack which they teach or recommend?" But one answer can be made; "We have been living in peaceable times, and battle and action signals have been dropping out of the Signal Book." What remains? Just ten articles of instructions for action which are mostly obsolete. We give Article VIII as a specimen. After some sensible directions about disabled ships, it continues, "And any fire ship in a situation to admit of its being done, is to endeavour to burn the enemy's ship opposed to her, and any small ships that may be near are to use every possible exertion for her relief, either by towing her off, or by joining in the attack of the enemy, or by covering the fire ship, or, if necessity requires it, by taking out the crew of the disabled ship, or by any other means which circumstances at the time will admit." It would be no doubt difficult to recast the above in a modern form, which is probably the reason why it stands in all its chaotic confusion, like an old building which cannot be touched without falling to pieces. When we add that in the "Action Instructions" there is no mention of rams or torpedoes, and that in the few signals allotted to action there is only one which alludes to "running down" the enemy, and one mention of a "torpedo" (apologetically coupled with "or incendiary" vessel, it will scarcely be contended that any attempt has been made to adjust the code to modern requirements for battle.

This is no doubt the true answer to Admiral Randolph's question. Modern naval warfare has so changed, and is in such a state of transition, that failing a direct order from higher authority to deal with tactics, modern Signal Book Committees have agreed to ignore them, except so far as an occasional verbal change in an old signal might adapt it to modern warfare.

We are not surprised at the result. It is only of recent years that it has come to be acknowledged that some attempts at least of a

solution of the problems of naval tactics may be attempted. But what a change from the days when the Signal Book was substantially a code of "Fighting Instructions;" too precise and rigid it may be, but which showed the goal at which fleets must necessarily aim. If we turn to the sister service, we shall find in the Field Exercise Book, under the heading "Application of Drill in Field Manœuvres," tolerably clear general principles for attack and defence. Cannot something be done in the same direction for the Navy? Are there no broad principles which might be shadowed forth in the Signal Book? At present it must be admitted we are groping in the dark. Our evolutions and manœuvres have no direct bearing on battle formations. The Signal Book is a useful drill book, but that is all, and it is not unreasonable if, in all earnestness and simplicity, we ask for something more than "a halfpenny worth of bread" for this "intolerable amount of sack."

We have put the want plainly, and we believe strongly; but we make no pretension to being original in making the complaint against the code of signals and evolutions now in force, that it is a mere drill book, and that nothing higher is attempted. We propose to conclude this chapter by showing that we are not alone in making this charge.

In 1872, in an article on "Naval Autumn Manœuvres," in *Naval Science*,<sup>1</sup> the author points out many ways in which our evolutions might be made to resemble more closely the tactics of active warfare, and he complains with reason of the "great loss of power in employing a gigantic and expensive fleet to teach the rudiments of drill." The article was written seven years ago, but we fear that nothing has occurred since to make it less applicable in the present day.

If it should be thought that the article we have referred to is too theoretical, or its demands obsolete, we again quote Vice-Admiral Randolph, a distinguished Officer of large and varied experience, whose high qualifications as an Officer and a seaman cannot be disputed. The Admiral writing in the present year says:—

"No doubt Flag Officers and others have formed their own opinions and determinations, but these are confined to their own breasts, and where are the younger Officers to turn for guidance, or so much as a hint as to the best way to engage either a single ship or a squadron?" . . . The Army systematically practise operations "as nearly as possible resembling those of real battle. Can we do nothing in the same direction?" Something can and will be done if once the want is felt by naval Officers, but in the words of the motto at the head of this Essay, "*Nil sine magno vita labore dedit mortalibus.*"

#### CHAPTER IV.—Strategy—Tactics—A Naval Action.

What is a ship? Is a question which the naval Officer may ask as innocently as did one of the fairies in the play of "Happy Land." If the choice is considerable in weapons, it is far greater as regards ships of war. The "Duilio," and "Lepanto," "Admiral Duperré," "Re-

<sup>1</sup> Supposed to be written by Captain Colomb, R.N., the Naval Prize Medallist in 1877.

"doubtable," "Pete rthe Great," "Inflexible," "Dreadnought," "Ajax," "Thunderer," "Alexandra," "Téméraire," "Northampton," and "Triumph," are all men-of-war, and are all armoured ships, though the armour is differently distributed; and in so-called ironclads alone, the various systems of armament adopted and advocated form fertile themes of discussion for the naval architect and the naval Officer. The ships above referred to are however all large ships, and are all armoured more or less on the modern principle of protecting the vital parts of the ship, while in the more recent examples side armour has been discarded altogether in favour of more complete protection afforded to certain portions. That the ships we have named, almost haphazard, would take their place in a line of battle few will dispute,<sup>1</sup> but what are we to say to rams, not only of the "Polyphemus" class, but other vessels such as the "Hotspur" and "Rupert," and the French rams "Bélice," "Bouledogue," and "Cabère?" Then we have the Greek alphabet class of Chinese gunboats with their 38-ton guns, which some people believe to have sounded the knell of huge ironclads. Lastly, we have the "Lightning" class of torpedo-boats, and the modified second class torpedo-boats carried by our modern ships, whose part is presumed to be to act as skirmishers to a fleet.

We see each class in turn vehemently supported by public writers, who boldly upbraid the Admiralty of the day for their folly and short-sightedness in not appreciating the requirements of modern naval warfare.

Fortunately we need but touch lightly on this thorny ground, which has been occupied by the last Naval Prize Essayist, but it is the part of strategy to distribute the forces at command in the most efficient manner, and some estimate must be formed of their relative value.

In Chapter II, when dealing with modern weapons, we summed up generally in favour of "ramming tactics," good broadside and moderate end-on fire, great speed as absolutely necessary for a ram, and the Whitehead torpedo strictly as an auxiliary.

Torpedo-boats will be chiefly useful at night, and in circumstances when in former days cutting-out expeditions or boat attacks were had recourse to, but in broad daylight such a mosquito fleet would have little chance against Nordenfeldts and Gatlings.

History has already shown us in the actions between frigates and sailing gunboats, the terms under which an "Alexandra," or "Inflexible" would meet a hostile fleet of "Gamma's," in the open sea, and we cannot doubt the result.

The proper function of a navy is but too often overlooked in modern days, when the proud title of Mistress of the Seas has been practically undisputed in our hands since the beginning of the century, but it cannot be too frequently repeated that the object of any real naval war must be maritime supremacy. It is this that the Dutch under De Ruyter and Van Tromp disputed with us in the seventeenth century, and that the French under Tourville, Suffren, and Villeneuve again

<sup>1</sup> We are aware that the question of the proper place of the "Nelson," "Northampton," and "Shannon" has been debated, but we think that few will doubt that they are fit to take their part in a naval action.

contested later. It is an old story now, and the object for which our naval heroes fought is too often forgot, or pared down to its lowest terms; thus even St. Vincent and Trafalgar have been described as actions due to blockades; we seldom appreciate the advantages in our possession, but foreign critics are more clear-sighted; as La Gravière expresses it, "*A quoi peut servir une marine? Je réponds sans hésiter, à occuper les grandes voies maritimes.*" To do this we require large vessels which can cruise and keep the sea, and of such ships our war fleet must mainly consist.

Mr. T. Brassey, M.P., who has given much attention to this subject, has pointed out the necessity for having ships of moderate size, and he objects to the Italian ships "Lepanto," and "Italia," which are 14,000 tons, as too large, and praises the Admiralty policy of building ships of not much more than 9,000 tons.

We need not, however, pursue this subject farther. Most people will agree that neither "Lepantos," "Dandolo," nor "Inflexibles," still less "Gammas," or "Deltas," are required for our ordinary fleet ship.

The "Polyphemus" is a novel experiment in naval warfare, but if she attains the speed and manœuvring capabilities she is intended to possess, we believe that she will prove to be a most formidable opponent, and we could wish to see the experiment repeated.

Other and higher questions of strategy are not here subjects for consideration. We deal with warfare in the open sea, and it is unnecessary to examine what proportion coast defence ships, gun-vessels, or unarmoured cruisers should bear to the fighting fleet. That portion of strategy which concerns us is the elimination from the fleet of all those vessels which are likely to be an encumbrance rather than a strength in an action in the open sea, either from their weakness, their unwieldiness, their want of speed, or from any other cause, leaving a homogeneous fleet capable of acting together in concert. We may then lay down two postulates:—

1st. That in any fleet intended for action in the open sea, the ships must be so far alike as to be able to act together against the enemy in any tactical evolution which the Admiral may require to perform.

2nd. That if special ships, such as rams, gunboats, or torpedo vessels, are attached to a fleet, they must act independently of other ships according to a pre-arranged plan, in which their peculiar qualities may be best developed.

Leaving now all strategical combinations of ships, or other modifications in tactics, which must necessarily be produced by the different qualities of the vessels of which a fleet is composed, let us assume, for the sake of simplicity, the tactics to be followed in a squadron or a fleet meeting another of equal force.

The ships are assumed to be ordinary ironclads of the "Hercules" class, capable of acting together at 10-knot speed. The problem to be solved is how one squadron, say of 6 ships, is to gain an advantage over another of equal force. In private life, and among some savage nations, it has been considered fair to give notice beforehand of any intended attack, so that it may be met on equal terms; but in modern

times, war once declared, the tactics to be employed are on a contrary principle, and may be summed up in the following axioms:—

1st. To surprise the enemy and attack him when he is unprepared.

2nd. To overwhelm a portion of his force with the whole of yours.

We are not now dealing with the first of these axioms. Jomini,<sup>1</sup> the French tactician, elaborates the latter as follows:—"The fundamental principle of war consists, first, in bringing the greater portion of the disposable forces of an army to the decisive point, whether of the theatre of war or of the field of battle; secondly, to operate in such a manner that this mass of forces should not only be present at the decisive point, but that it shall be cleverly brought into action."

So far all are agreed, but if we attempt to derive inspiration from the numerous naval writers who have studied the subject of a naval engagement between ironclads of the present day, we are startled at the wide differences of opinion expressed, not only as to the strength of various formations, but as to the manner of fighting which will be adopted. As a rule, strong assertions have been made and decided opinions given, based on necessarily weak arguments and weaker facts. A victory (on paper) has been gained by the A's through ignoring the possible combinations of the B's. A very general belief, shared apparently by foreign writers, has been that fleets will clash together in line abreast, and that they will subsequently pair off to decide the action, forming a series of independent duels. A writer who has studied this subject historically views such a battle as "almost an impossibility,"<sup>2</sup> and he is not alone in representing the line abreast as a very "weak tactical formation." On the other hand, we have foreign authorities<sup>3</sup> advocating the line abreast as the only effective tactical formation, and objecting to the inherent weakness of line ahead, while the English naval writer<sup>4</sup> who has given most attention to this subject prefers line ahead to any other combination. Of groups we have already spoken in a previous chapter, but it is certain that we cannot look to groups as furnishing a common ground of agreement.

Meanwhile we are not disheartened at finding that there is no beaten road on which to travel, as we are convinced that by discussion and argument, and by such helps as the Naval War Game when adapted to squadrons, sound principles will at length be arrived at, the truth of which can only be shown by the crucial test of a naval engagement. It is not improbable that national characteristics may cause different nations to adopt different views of tactics, and that we shall be well acquainted with the strength and weakness of each other's formations when a naval war bursts upon us, and the real trial is at hand.

If we view rather more closely the arguments used by naval tacticians, we shall see that after all they do not differ so much in the result to be gained by certain formations, but rather as to the weapons to be used to ensure the victory. Thus Captain Colomb<sup>5</sup> proposes to

<sup>1</sup> "Tableau Analytique."

<sup>2</sup> Mr. Laughton's Essay, written for the Junior Naval Professional Association.

<sup>3</sup> Admiral Bourgois, *Revue Maritime et Coloniale*.

<sup>4</sup> Captain P. H. Colomb, United Service Institution Lecture, 1872.

<sup>5</sup> "Naval Tactics," an article in "Naval Science," vol. i.



gain an advantage by adopting the line ahead and practically "doubling on the enemy" by pouring a succession of broadsides from each of his ships into one or two ships of the enemy. Clearly he proposes to win by his guns, and though he speaks of ramming in certain contingencies, it is a secondary consideration. Captain Colomb may be right in his view of a general action, but he will scarcely support "line ahead," when, should the leader, for instance, be rammed, the rest of the squadron must be huddled up in a heap on the top of her, as specially suitable to ramming tactics.

If we study the views of the French writers, we shall see the same comparative agreement, accompanied it is true by a fundamental difference, as to the part to be played by the ram. In their view of tactics the ram is the effective, if not the only, weapon; guns are ignored till after the first collision of the two fleets, which is assumed to take place in line abreast, for it is argued that any other formation exposes the leading ship to be rammed by more than one of the enemy. All must, therefore, be placed on equal terms, and this can only be done by the ships being ranged in line abreast.

On one point all tacticians are agreed, namely, the great advantage which the attack gives. In a naval battle there is little time for consideration as the fleets approach each other, and still less opportunity of retrieving a disaster. Almost the entire force is brought into action at once, and a naval action rather resembles a charge of cavalry than a land engagement, where the troops are brought gradually into action, and where differences of ground and fortified posts afford opportunities for checking the advance and recommencing the engagement on equal terms. In naval actions, even in former times, the advantages of the offensive were always great, although it is true that they were almost neutralized in the eighteenth century by the supposed requirements of the line of battle; but if we wish for an example of the moral effect of a bold attack, we must turn to the almost plaintive report of Villeneuve to the French Minister of Marine after the Battle of the Nile, which is too long to quote here. He relates how the English fleet came in sight, steering directly for the bay; how it was hoped that Nelson might defer his attack till the next day, and give time for better dispositions of the French fleet, and how the hearts of the French Officers fell as they saw that their hopes were delusive. We need not dwell on the brilliant victory which followed, but in these days with steam fleets not hours but minutes will elapse after they are in sight of each other before the engagement has commenced. Let us, however, give our views of a naval action with 6 ships.

Taking the two extremes as crucial examples, A's squadron of 6 ships is in line abreast; B's squadron of 6 ships is in single column line ahead. The squadrons being mutually desirous of engaging steer towards each other. We will assume the ships in each squadron to be 2 cables apart. At 2,000 yards the leading ship of B is only three minutes from the centre ships of A's squadron. A observing no change of course on the part of B, forms the opinion that it is his intention to pass through the centre of his line, "doubling upon" the two centre ships 1 and 6. It will be seen that the Admiral of A



has placed himself in the centre of the line for better observation and command of the column.

A hoists plan F and slackens speed slightly, 2 and 3 instantly increasing speed and endeavouring to get into échelon with 1 on the signal being dipped. In about two minutes more, when B's 1 is at 900 yards distance from A's 1, the signal is hauled down. 4 and 5 instantly put their helms hard astarboard, 2 and 3 give moderate port helm, taking care to pass ahead of 1; 1 and 6 receive the fire of B's 1, allowing her to pass them; 6 then turns to starboard, 1 to port, unless either should see a good opportunity of ramming B's 2. Fig. 10A gives the position of the ships on the signal being hauled down, and with B's 1 maltreated by the broadsides of two of A's ships, 2 and 3 probably rammed by A's 5 and 4, 5 and 6 threatened and in danger from A's 2 and 3, we do not think that A would have much trouble in bringing the action to a favourable issue. If, when at 2,000 yards distance, B alters course 4 points to starboard, with the intention of passing out 3, A hoists plan A, which simply directs a change of course of 4 points to port and an attempt to ram the enemy's leading ships. In this case all will depend upon the turn being made at the right moment, but it is evident that both squadrons are now in similar formations and that there is no tactical advantage with either side. (See Fig. 11.)

On considering these figures again, we see a certain difficulty in the rigidity of a line of even 6 ships. In Fig. 10A we have endeavoured to gain an advantage by working by squadrons or groups, omitting the two centre ships, and we think that the defence would be still stronger were the two squadrons 4 cables apart, which would thus enable the two centre ships to work with their respective squadrons, and the process of re-forming would certainly be facilitated. The signal would have to be hauled down when B's 1 was about 700 yards from A's 1. (See Fig. 10B.)

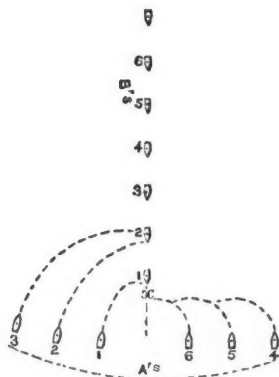
If we now consider the case of 12 ships, and place these 12 ships in line abreast, a formation which B's logical instincts have led him to adopt, and which we believe he will attempt to maintain under all circumstances, how are we to attack? Certainly not in line ahead, as we have seen that no advantage is to be gained by such an attack, which involves considerable risk. Two lines ahead would be better, but they are still open to the objection we have urged to the line ahead.

We have seen that the line abreast is too rigid a formation to maintain easily, and we think that a little consideration will show that it partakes of the strength and weakness of the old line-of-battle in the days of wooden sailing ships and broadside fire.

Our own view is, that if the line abreast is rigidly held, it can be forced without much difficulty by a squadron in any other order except perhaps line ahead.

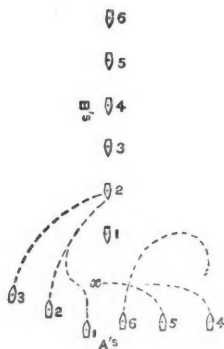
An échelon of service groups would probably succeed in gaining an advantage, and two lines ahead, if the columns were close together, would be superior to the one line abreast.

FIG. 10B.



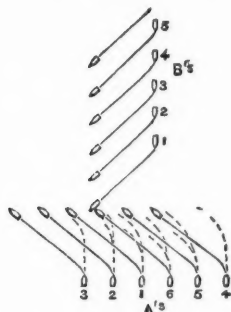
In figure A's 6, 5, and 4 are supposed to arrive at the collision point  $x$ , in the same time as B's 2, 3, and 4, or rather a few seconds later. A's 2, 3, and 1 threaten B's 5 and 6 at about the place of B's 2.

FIG. 10A.



In figure A's 5 and 6 are supposed to reach the collision point  $x$  in the same time or rather later than B's 2 and 3.

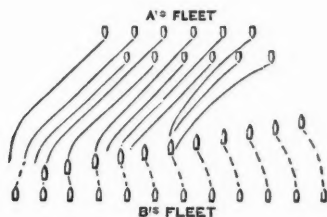
FIG. 11.



A's 2 and 3 threaten B's 5 and 6 at about the place of B's 2.

In figure it is evident that A is at a disadvantage if he turns at the same time as B, and he should wait till B<sub>1</sub> is nearly ahead of A<sub>3</sub> before turning. Should B then attempt to carry out his manœuvre by turning to port, with line ahead, at the same time as A turns to port to get into échelon, it is probable that B's last ships would be cut off.

FIG. 12.



To gain the full advantage of the enemy's weak formation, it is evident that we may meet him on his own ground whilst still opposing two ships to his one. We accordingly form in two columns of four groups or squadrons in line abreast, the rear column, or second division, occupying the interstices between the ships of the first line. The divisions to be 2 cables apart, thus forming nearly an identical line abreast, or French pelotons reversed. Now we prefer cutting off the enemy's wing ships, and we should endeavour to charge 5 ships from the right or left of his line. We accordingly alter course 4 points to starboard, and if the enemy attempts to maintain his formation by wheeling, we shall have attained our object before he has completed his movement.

Plan G has previously been made, the signal is hauled down, the

course is altered 4 points to port, and in a few minutes the 5 port wing ships of the enemy find our whole 12 ships upon them in such a formation as to give them no possible advantage. (See Fig. 12.)

But it will be said "You are assuming too much." B's fleet will retain its formation in line abreast whilst altering course together to prevent A's fleet from cutting off the wing ships. Let us assume that B alters course 4 points to port. It is now a trial of speed, and if A's fleet has the greater speed he can choose to attack whichever wing he may prefer. Even if he has not this advantage, he may, by a sudden alteration of course, attack the right wing of B's fleet, or should he fail to obtain any tactical superiority, his formation is so superior that he may gain his victory by boldly cutting through the enemy's centre. We hold that there are many advantages in this formation. The attack in an open échelon will be nearly as effective as the line abreast; in an alteration in course of 4 points either way, the ships of the second line will have one of the first line ahead, which will tend to keep the formation, whilst in the direct attack each ship of the second division will be clear of the first division ships and be able to support their friends.

Such is our idea of an attack on a line abreast. Admiral Randolph's plan of two divisions in échelon working separately is admirable if we could be quite sure that the divisions would not be too much separated, but we prefer concentration to division as involving few risks.

Against 2 columns in line ahead, we should propose 2 columns line abreast, ships at 1 cable apart, and columns 4 cables apart. The ships of the second division to act with and support their opposite numbers in the first division. It is a formation which was adopted as a "*memorandum de combat*," by a distinguished French Admiral during the Franco-Prussian War, the columns being 6 cables and the ships 2 cables apart.

To sum up our recommendations—

- (1.) We prefer in all cases concentration to dispersion.
- (2.) We believe long lines, whether lines ahead or abreast, to be dangerously weak formations.
- (3.) We consider lines abreast or very open échelon the most favourable for ramming tactics.
- (4.) We work our fleet in groups for better subdivision and command, but we do not adopt the scalene triangle formation as suitable for fighting purposes.
- (5.) We hold high speed as absolutely essential to tactical efficiency. Such are our theories.

We will now endeavour to picture a naval action.

At last war is declared. To most people it was a relief to have it so decided. For months some of the principal nations had been, "snarling at each other's heels." Confidence had long since disappeared. Trade was so slack from fear of the enemy's cruisers, that "Lean look'd prophets whispered fearful change," and "Rich men 'look'd sad," in expectation of the evils coming on the country.

The papers were full of recriminations as to the cause of the war, the only things quite certain being that somehow or other "we had drifted into it," and that two if not three of the most formidable naval Powers in Europe had united, in the determination, if possible, to destroy the power and influence of this country by attacking her naval Empire.

For once in recent years the fleet was all-important and received the larger part of public attention. Our Colonies, our commerce, and our very existence as a nation depended upon the Navy.

Foreign squadrons had been strengthened, fast cruisers, many of them converted merchant steamers, had been dispatched to the various maritime highways for the security of our merchant fleet; some attempts had been made to fortify our coaling stations which had been recently replenished with coal, and wherever British interests were threatened, and that was everywhere, cruisers were at hand to undertake their defence.

The larger Colonies were ready and willing to protect themselves, but they wanted both ships and skilled seamen, and the Admiralty were almost bewildered at the demands made upon them.

Already 10 ironclads, as shown below, were in distant seas, besides 10 in the Mediterranean, but no more could be spared, as it was felt that the great struggle must be in the Channel, where our opponents had cleverly succeeded in concentrating a force of 25 ironclads.

The following was the distribution of the fleet when war broke out, for the ironclads had been the first demand upon the dockyards, and this task completed, the object was to turn out cruisers, and repair the best of the old wooden ships which had long remained in ordinary. The "Davy Jones," a sister ship to the "Polyphemus," had just been completed when war was declared, and 4 similar vessels were building in private yards, but as they were too late to take an active part in the war we have omitted them from our list.

*Channel Fleet, Head-Quarters at Portland.*

1st Division.	2nd Division.	3rd Division (turret-ships.)
"Alexandra," Flag of Commander-in-Chief.	"Agincourt," Flag of Rear-Admiral.	"Inflexible," Flag of Vice-Admiral.
"Hercules."	"Sultan."	"Devastation."
"Lord Warden."	"Invincible."	"Agamemnon."
"Minotaur."	"Northumberland."	"Dreadnought."
"Nelson."	"Northampton."	"Monarch."
"Bellerophon."	"Shannon."	"Neptune."

*Rams.*

"Polyphemus."  
"Davy Jones."

*Mediterranean.*

"Superb," Flag of Commander-in-Chief.  
 "Téméraire," Flag of Rear-Admiral.  
 "Triumph."  
 "Achilles."  
 "Thunderer."  
 "Ajax."  
 "Belleisle."  
 "Orion."  
 "Hotspur."  
 "Rupert."

*Foreign Stations.*

"Warrior."  
 "Black Prince."  
 "Repulse."  
 "Hector."  
 "Valiant."  
 "Defence."  
 "Resistance."  
 "Audacious."  
 "Swiftsure."  
 "Iron Duke."

*Home.*

"Penelope."  
 "Glatton."  
 "Cyclops," and other coast defence ships.  
 Gunboats.

The Channel Fleet was at last complete at Portland, where it had been assembling for some months. The Commander-in-Chief had been selected with due care, every confidence being felt in him, though he was said to have never seen a shot fired. The junior Admirals and Captains were all experienced men, who were believed to be good tacticians, capable of understanding their chief *à demi mot*, and it was believed that but one spirit animated both Officers and men.

The composition of the Channel Fleet formed a fertile source of criticism. Some ships were too long, some were too weak, some had no side armour, one was a mere wooden ship offering no security against torpedoes, and every diversity of opinion, from that of trusting entirely to "Staunches" and torpedo-boats, to that of confiding in "Inflexibles" and "Dreadnoughts" was represented.

It was certainly impossible to assert that we possessed a homogeneous fleet, but viewed separately the ships were extremely powerful, and it was hoped that their individual strength, and the known ability of the Admiral, would compensate for any difficulty on the score of their diversity of character. In the turret division it was felt that we had an extremely powerful squadron, superior to any similar number of ships of the enemy.

In selecting the ships for the manœuvring fleet the Admiral's opinion had naturally great weight, and he insisted on two qualifications as essential. He demanded an extreme speed of not less than 12 knots, and that the ship should be a ram. He was understood to attach great value to the "Polyphemus," and it was at his instance that her sister ships were ordered.

The ships of the fleet at Portland as they arrived were put through a course of experiments as to their evolutionary powers, which were duly tabulated by experienced Officers of the flagship. Each Captain, Commander, and First Lieutenant had in turn to practise handling

their ship so as to ascertain her qualities, and exercise their own faculties. It was surprising to see how all Officers improved in the figure of 8 practice round buoys, which was a part of the course, in a short time. The useful helm-angle for each ship, to correspond with that of the flagship, was carefully ascertained, as well as "half helm" and "quarter helm;" and, notwithstanding the different natures of the ships, with constant practice and the care taken to tabulate results, every confidence was felt that the fleet would manoeuvre effectively in concert. But little time was left after the whole of the ships had assembled for general evolutions, but that time was well employed, not in mere evolutions, but in tactical experiments.

In gunnery the Admiral had persuaded the Admiralty to give him an old corvette, which was anchored near Portland, and prevented from sinking by Popoff air bags and other camels under water, against which target ships were accustomed to try their gunnery efficiency.

In fine weather the hull was expanded by canvas screens to the size of an ordinary ironclad, and the shot holes were found to have furnished some remarkable proofs of the value of end-on fire or otherwise, and of the effect of smoke from guns and funnels under different circumstances, as the experiments were carried out in imitation of actual warfare, all ships having to fire when approaching and receding at speed, &c.

Some trials of firing at moving objects were also carried out, large barges with canvas screens representing a small vessel being towed by one of the other ships. The comparative value of electric broadside and independent firing was also in this way made the subject of crucial experiment.

Some manoeuvres of one division of a fleet against another to endeavour to gain information as to the effect of smoke on manoeuvres furnished remarkable results. A large number of tactical signals found their way into the Signal Book, splinter nettings were in all ships secured to the ship's side, an outrigger torpedo on a special plan of a swinging boom working on a hinge under the fore chains, so fitted as to be rigid at 10 feet below the water-line, and 40 feet from the ship's side, was directed to be held ready in every ship. These torpedoes were to be fired by electro contact, a special battery being used for them.

Such were a few of the preparations made by the Admiralty and the Admiral, and fortunately in 188- time for preparation was given.

Some time before war had been declared the second division of the Channel Fleet under a popular Rear-Admiral was sent to cruise off the enemy's port. His orders were in the event of war to decline an action, but as the enemy boldly came out of port with only an equal number of ships the challenge was accepted. In fighting power the enemy's squadron was not more powerful than our own, but it had a great advantage in manoeuvring, the ships being similar in all respects.

The enemy being formed apparently in line abreast, but really (as subsequently ascertained) in a very open échelon, the Admiral formed in service groups (scalene triangle) in line abreast; hoisting plan H as the signal for engagement.

The groups were formed to the right, and it being observed that the enemy's ships were only a cable apart, the leaders of groups were closed to 2 cables.

The instructions by plan H were to "cut through the enemy's line, "steering the same course as the Admiral," the general instructions being—"No. 1 to pass through without using the ram unless in self defence; No. 2 to endeavour to ram an opposing ship of the enemy; "No. 3 to cover No. 1." This instruction had been drawn up in view of the great length of three of the group leaders. "When through the enemy's line, ships to stand on about half a mile, circling round to starboard if possible to renew the action. Ships to follow motions "of group leaders." "Ships to use electric broadside firing in commencing the action. Whitehead torpedoes as occasion offers. Bow fire not to be opened except by signal in approaching the enemy."

But little manœuvring was attempted, and the charge of the opposing lines began; the "Agincourt" had just fired her port broadside when a ship emerged from the smoke on her starboard side, and delivered a ramming blow near the mizenmast with such force as to fill two of her after compartments and damage her rudder.

A broadside was fired at the ramming ship, but the guns having been laid 25° before the beam only a few of them took effect, and a Whitehead torpedo was not more fortunate.

It was soon seen, both by the enemy's ship and by those on board the "Agincourt," that she was disabled and sinking. The former having had her way stopped by the collision was preparing to repeat the blow; but this had been anticipated, and two torpedo-boats were smartly lowered with steam up; these satellites under dashing Sub-Lieutenants devotedly threw themselves in the path of the enemy, forcing her to swerve from her course, and saving the "Agincourt" from further molestation till her consorts could come to her assistance.

How one torpedo-boat escaped, and how the other was destroyed is well known; but the only two survivors of the latter have never agreed as to whether a shot from a gun, a Gatling, or a hand grenade, destroyed the boat just as her torpedo was about to be exploded. It is only certain that her gallant attempt to blow up the enemy failed, and that the crew with two exceptions fell a victim to the temerity which had saved the "Agincourt's" crew at the expense of their own lives.

The action was now over, our remaining ships were but little injured, and the enemy did not resume the offensive. But in spite of collision mats, sails hauled under the bottom, steam pumps, &c., the "Agincourt" was lost, though her crew were saved, and the first naval action of the war had resulted unfavourably for us. It was subsequently found that our opponents' instructions were to ram No. 2 of our groups, but that the Captain of the "Redoubtable," finding that he was not observed by the "Agincourt," and seeing her great length, took advantage of his opportunity to ram her. Our No. 2 had attempted to ram another ship, so her attention was distracted, while No. 3, being on the port side, had been unable to assist her leader.

We need not refer to the outcry against the gallant Admiral, but



from this period groups were discredited. It was also found that the gray hue which all our ships had previously been painted was too colourless, and an order was instantly carried out to paint the ships black with one broad white ribbon above the ports, to be carried right round the bow and stern.

How this defeat was avenged by the Commander-in-Chief it is scarcely necessary for us to relate in detail. How the Admiral met the enemy, who was in his favourite formation of one line abreast, in three lines abreast, the turret division leading, with the rams in the rear, is well known, and how the three lines formed a sort of chequer-board, not being directly in rear of each other, has been made familiar on every dining-room table. How, by altering course at high speed, the Admiral succeeded in doubling on the right wing of the enemy, which he eventually bore down upon in *échelon*; of the *mêlée* which ensued, in which the "Polyphemus" and the "Davy Jones" played such an important part, and the relief which was felt in England as the intelligence of the brilliant victory was flashed through the land, is an off-told tale, of which it is too early yet to write the history, but we add a few remarks on the lessons that were derived from the action.

We had taken six ships and sunk six ships of the enemy, chiefly through superior manœuvring of our ships at high speed, the ram being the effective weapon. We had lost another of the long ships through her bad steerage, thus setting at rest the controversy as to the loss of the "Agincourt." Gun fire proved itself most valuable in the single ship actions, several of which were developed after the first charge, the turret-ships showing great superiority under the circumstances. In pursuit, too, the gun was invaluable. The Whitehead torpedo failed to act generally, though it was singularly successful on one occasion, the outrigger being, however, equally fortunate. The enemy's Harvey torpedoes were harmless.

It is well known that we captured six and sunk six ships of the enemy. Of those sunk, four may be considered due to the ram, one to the gun, and one to the Whitehead. Of those taken, three were due to the gun, two to the ram, and one to the demoralization caused by bursting of the outrigger torpedo. The lessons of the action are—

1st. That a long line is a weak formation.

2nd. That high speed is invaluable.

3rd. That regular rams are most formidable in a general action.

4th. That smokeless coal is a great advantage, our Admiral's determination to have only the best Welsh coal having been of considerable service in accurate signalling and station keeping.

5th. That, on account of the smoke, it is most important, if possible, to attack the weather wing of the enemy.

Here our sketch would end, but that a scheme of night attack, which was never carried out, has reached us, but as it appears valuable we give it as follows, premising that it is only a fragment, the Admiralty having very wisely gathered all the experience and tactical considerations of the late war into a confidential volume, to be issued to Admirals:—

"In a night attack with rams and torpedo boats the fleet will be formed in two lines ahead, the ordinary number of cables apart, rams in line abreast between the lines, torpedo-boats astern or alongside their respective ships. Should the enemy discover the nature of the attack, the general recall will be made, the Admiral's motions to be attended to, torpedo-boats hoisted up, if possible, rams to resume station.

"Boats not hoisted when an evolution is to be performed are to act independently of the fleet, under cover of reserve squadron. Should the enemy attack, the ships are to form in indented line at night, and the action once begun, are to act with group leaders.

"If all goes well, and the fleet can approach the enemy sufficiently near before being discovered, at a given signal the fleet will alter course together, reversing outwards rams, followed by torpedo-boats, at full speed, charging the rear of the enemy, supposed to be in two or more lines ahead. After the first attempt, torpedo boats will go out of action, retiring towards the enemy's original rear. The fleet, when boats are well clear, will probably again alter course together towards the enemy's van, and charge in indented line. Rams to act as may seem best during the action."

"After the first charge, unless a distinct opportunity for ramming is afforded, the ships are to endeavour to pick up their torpedo-boats, and form in two lines, ready to renew the action after daylight.

We now take leave of our supposed naval war of 188-, and return to the style befitting this serious Essay. We have not, we think, taken a liberty in endeavouring to depict the probable results and tactics of modern naval warfare. We have taken our Navy as it is or as it probably will be in a few years hence, and in this sketch we have endeavoured to show where our weakness is likely to be, and to the best of our ability how and where it may be remedied.

That much has been left unsaid, that some points have escaped our notice, and that many subjects have been inadequately treated, we are painfully sensible, but we have tried, as far as possible within the compass of this Essay, to touch upon all those topics which are connected with naval tactics in the present day, and we have spared no pains, with the limited time at our disposal, to treat our theme worthily, as our motto, "*Nil sine magno vita labore dedit mortalibus*," suggests to be requisite.

Let naval Officers only be true to themselves, in the spirit of the above motto, and we may feel well assured that foreign Powers, who "cast a long look where England's glories shine," will also recollect, in the words of the same poet, that

"Self-dependent power can time defy,  
"As rocks resist the billows and the sky."

Friday, January 23, 1880.

LIEUTENANT-GENERAL Sir J. HENRY LEFROY, K.C.M.G., C.B.,  
R.A., &c. &c., in the Chair.

---

### LESSONS TO BE LEARNED FROM KRUPP'S MEPPEN EXPERIMENTS OF 1879.

By Captain C. ORDE BROWNE, late R.A.

THE purpose of this paper is to take a short review of the most characteristic features of the Krupp *matériel* experimented on at Meppen last summer, calling attention chiefly to the best results, and comparing them with corresponding ones obtained in this country, with a view to promote the discussion of those matters in which it may appear that we have most to learn.

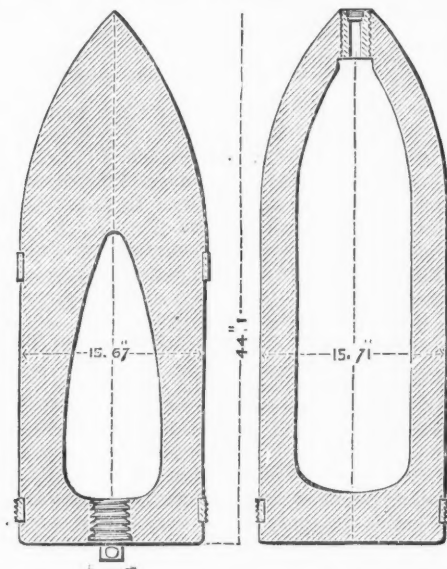
The principal feature in the Meppen programme was the trial of Krupp's 40-centimetre (15·75 inch) breech-loading gun, weighing about 70 tons 17 cwt., known commonly as the 71-ton gun. (Fig. 1.) The trial was specially important for three reasons. 1st. It is the first breech-loader whose power approaches that of the 100 and 80-ton guns made in this country; 2nd. It is a steel gun; 3rd. Its proportions are based on results obtained during the last few years.

All these questions are interesting, and deserving of so much attention that it would be difficult here to deal fairly with all. For the purpose in hand, however, it is not necessary to discuss the question of the respective *metals* of the guns, because it can easily be shown that there was nothing in these experiments that bears upon this point beyond the negative fact that the steel guns in no respect exhibited any fault. We may safely say that our Woolwich guns would have done equally well, as far as the material is concerned, for the pressures in Krupp's guns were by no means excessive. The 71-ton gun, for example, was not subjected to as high a pressure as our own 80-ton gun has borne. A test which tries neither gun obviously furnishes us with no means of comparison, and hence the Meppen trials in no way furnish data for the discussion of the relative merits of wrought iron and steel guns, but bear entirely on the two other questions, namely,

The Institution is indebted to the Proprietors of "The Engineer" for some of the illustrations.—Ed.

that of breech-loading and proportions—the former as concerns ease in working, and the latter power and good shooting.

The 71-ton gun, Fig. 1, was mounted as for coast defence, on a traversing platform, and a carriage nearly of the English pattern in all respects. The brackets were made of wrought iron, the gun being elevated by multiple gear, N, acting on elevating arcs, O, fixed on the gun. Beneath the carriage were two hydraulic buffers. A modified form of Cunningham's chain gear, RR, was used for traversing the platform, which ran on trucks on three concentric racers, the pivot being about 6 feet in front of the carriage when run up. A lifting crane, J, was attached to the platform, fixed on a sort of axle, K, with a counter-lever with powerful spring, L, which required considerable force to compress it by bending down the crane, and which decreased the work of lifting the projectiles by the same amount, thus dividing the labour of lifting the projectiles into two operations.



15.75 IN. (40 CM.) CHILLED SHELL.		COMMON SHELL.
Weight of shell, empty.....	1,690.6 lb.	1,338 lb.
Weight of bursting charge ....	22 lb.	73 lb.
Weight of shell, filled..	1,712.6 lb.	1,411 lb.

The gun was easily worked by a detachment of fifteen men. Ten rounds, with chilled projectiles, were first fired; the time occupied by the last five rounds was twenty-four minutes. The breech piece moved



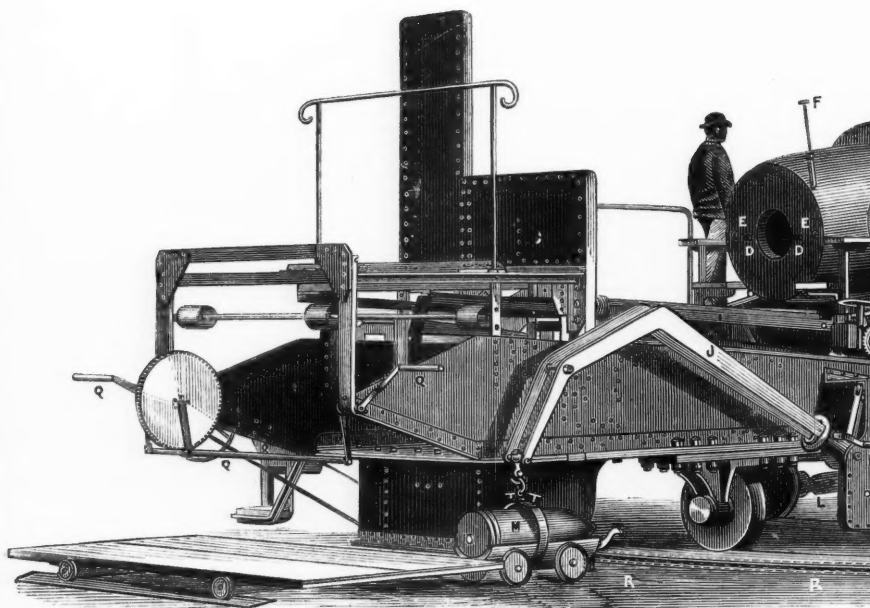
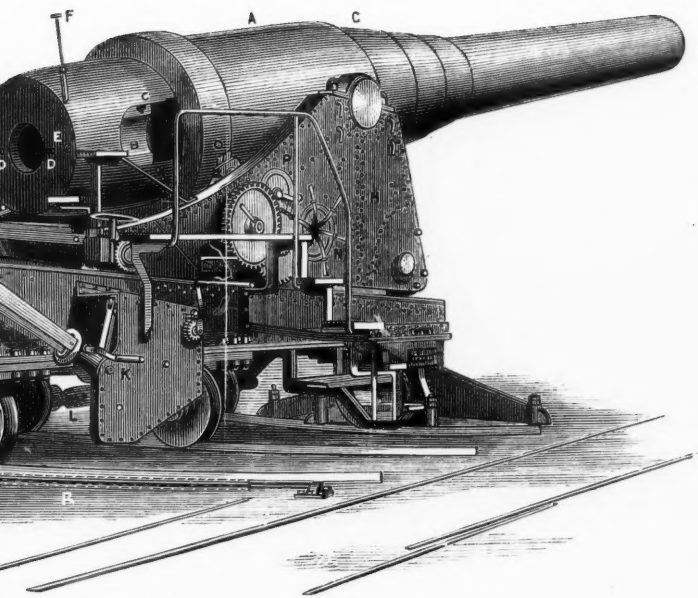


Fig. 1.—16 IN. (71 TONS) GUN MOUNTED ON COAST.

A—40 centimetre (15·75 in.) gun, length, 32 ft. 10 in.  
 B—Breech-closer, showing C end of driving screw.  
 D D—Studs for hooking on shot guide.  
 E E—Rings for rammer pulley blocks.  
 F and G—Tangent and trunnion sights.

H—Carriage, wrought iron.  
 I—Loading platform.  
 J—Crane, pivoting vertically on pillar hinged horizontally,  
 counterspring on arm L beneath the carriage.  
 M—Chilled iron projectile.

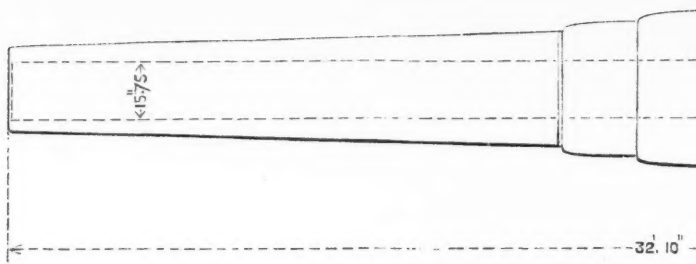


NTED ON COAST-CARRIAGE.

hinged horizontally at K with  
the carriage.

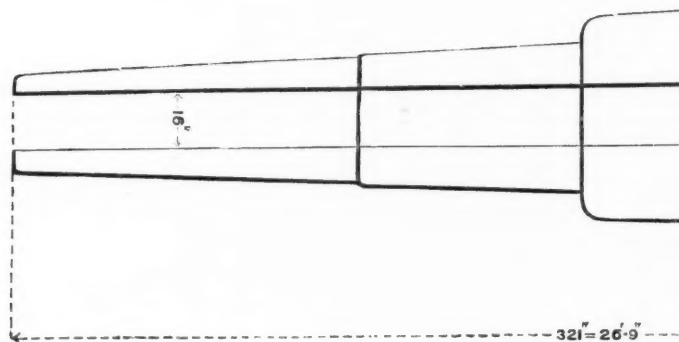
- N—Hand wheel for elevation with train of wheels working on toothed elevating arc O.
- P—Graduated disc, showing quadrant elevation, being set by reverse (inner) edge of elevating arc.
- Q Q Q Q—Handles for working traversing gear.

FIG. 2



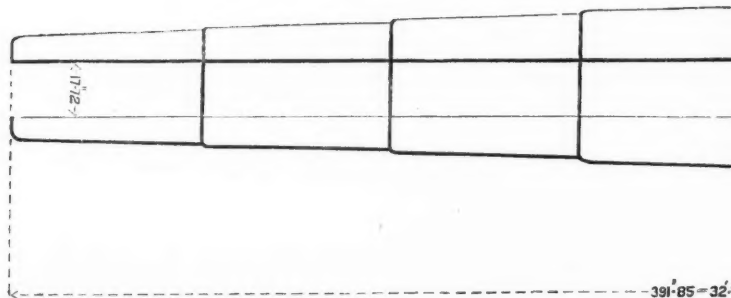
KRUPP'S 15.75 IN. (40 CM.) 71-TON GUN.—WEIGHT

FIG. 3.



WOOLWICH (16 IN.) 8-TON

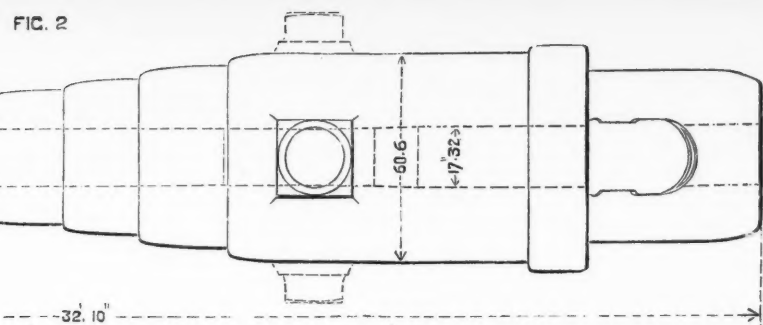
FIG. 4.



ARMSTRONG (17.32 IN.) 10-TON

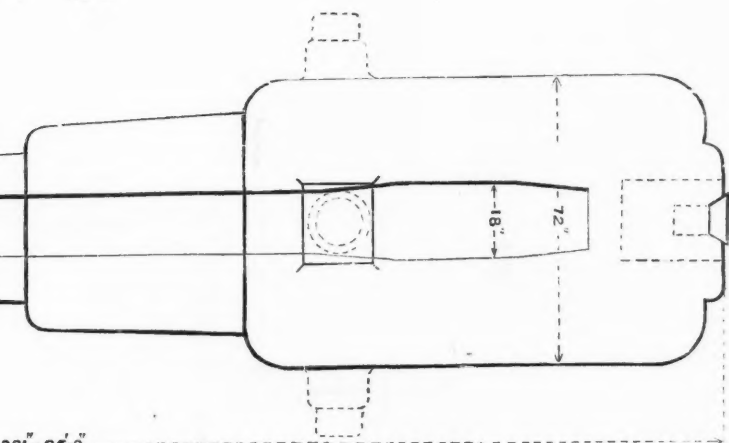


FIG. 2



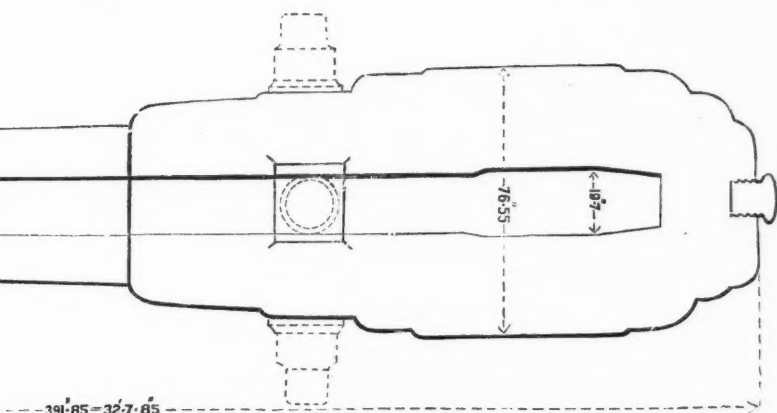
GUN.—WEIGHT OF GUN WITH WEDGE ABOUT 71 TONS.

FIG. 3.



OLWICH (16 IN.) 80 TON GUN.

FIG. 4.



TRONG (17.32 IN.) 100 TON GUN.



easily. A good deal of oil was used on it. The breech-loading certainly saved the men much labour, not only in the actual ramming home, but also in bringing up the projectiles, since it was not necessary for them to cross any of the racers or the Cunningham chain. The charge was made up in four cartridges, each containing 110 lbs. of prismatic powder. The least satisfactory part of the service of the gun was the difficulty experienced in the ignition of the charge and in remedying miss-fires. The vent was in the axis of the piece, and a disk of calico was torn off the bottom of the cartridge last entered, to expose the powder to the flash of the tube. The latter was of a bad pattern, short and weak. No stress is to be laid on this, as the remedy is obvious. A primer or a stronger tube would rectify this fault. A rather more serious difficulty was apparent when a miss-fire had occurred. The position of the vent was such that it was unusually dangerous to approach it while there remained any likelihood of the gun going off. A gunner may insert a tube in a vent in the top surface of a gun with comparative safety, but to thrust his hand into the cavity in the breech, and in such a position tamper with a doubtful tube and charge, would indeed be dangerous. On active service the risk, no doubt, would be run, and it is possible, if the man stood on the step of the carriage and reached round so that the gun in any unexpected recoil should carry him with it rather than run over him, that he might escape without injury. Nevertheless, while this modifies the objection, it remains sufficient to make it imperative to construct some implement to enable a tube to be removed and another entered with safety, even should a miss-fire be a much rarer occurrence than it was at Meppen last summer. The flash from the vent has been spoken of. This is an objection which belongs to all axial-vented guns. There was but little flash in Krupp's guns at Meppen, owing to an arrangement by which a loose platinum ball in the vent is driven up out of the way by the flash of the tube, but pressed back so as to close the vent by the rush of gas from the charge. An Italian Officer stated that this ball is not serviceable, but becomes worn and of little use after a time. Under any circumstances this difficulty is one connected with axial vents rather than with breech-loading.

A more important question is the shooting of the gun as regards power and accuracy. The chilled projectiles had 0.078 in windage, which is about the same as that in Woolwich projectiles, namely, 0.08 inch over a copper rim. The common shell subsequently fired, however, had the impractical windage of about 0.01 inch over an iron body.

The diagrams Nos. 1 and 2 show a remarkable degree of accuracy, chiefly in the vertical direction, which argues well for the regularity of the charge, which surely must be attributed to the prismatic powder employed. It stands to reason that a charge composed of a fixed number of prisms of uniform size and density gives promise of greater uniformity being attainable than when pebbles are employed; and there seems no reason to doubt that whatever difficulties were at first experienced this has been achieved. Surely if two attempts are made to obtain regularity in powder—one by employing prisms each

uniform in size and shape, and if possible pressed uniformly, and another by means of pebbles of an accidental shape from uniformly pressed powder cakes—the former, though it may be difficult, offers promise of

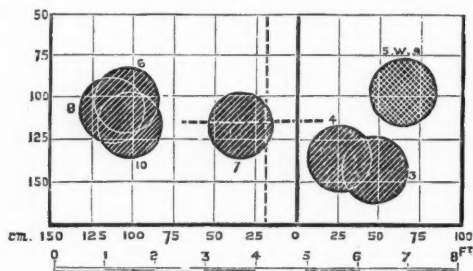


DIAGRAM 1.

Group of Hits on Target made by 71-ton Gun at 2,734 yards Range.

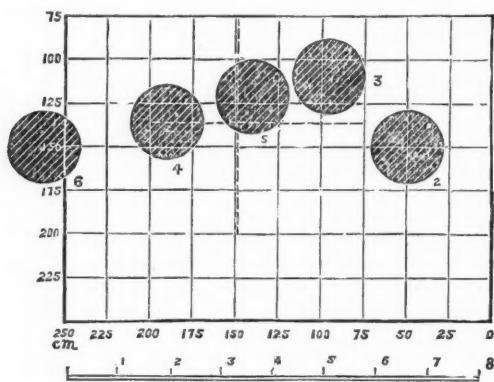


DIAGRAM 3

ultimate success in the higher degree. As to the windage, stress can hardly be laid on the great reduction in the case of the common shell; the two kinds of projectiles made pretty nearly equally good practice.

Lastly, as to the proportions of the bore and chamber. The most striking feature is the length of the bore. Figs. 2, 3, and 4 show the relative lengths of the best heavy guns at present in existence, by which it appears that the bore of the 71-ton gun is only 20 inches shorter than that of the 100-ton gun, and 55 inches longer than that of the 80-ton gun. The chamber in length is 60.6 inches, that of the 100-ton gun being 59.7, and of the 80-ton gun 59.6. The calibre of

the 71-ton gun is 15.75 against 16 in the 80, and 17.72 in the 100-ton gun. Consequently, the bore of the 71-ton gun is 21.8 calibres long against 18 in the 80, and 20.5 in the 100-ton gun. The diameter of the chamber of the 71-ton gun is 17.32 inches, that of the 80 and 100-ton guns being 18.0 and 19.7 inches respectively, that is to say, it is 1.57 inches greater than that of bore as compared with 2.0 inches increase in the 80, and 1.98 inches in the 100-ton gun.

Speaking generally, then, the bore of Krupp's gun is relatively rather longer, and the chamber less enlarged than in the 100-ton gun, while in the 80-ton gun the bore is actually the shortest, and the enlargement of the chamber actually the greatest of the three.

On these proportions mainly depends the power of the guns. To be able to make a comparison between them, discrimination is necessary. It would not be right to take equal or proportionate *charges* as the basis of the comparison, because the principle on which a long gun is advocated is, that any greater result can thus be got from a gun with a given strain on it, but at the expense of some waste of powder.

It is clear, then, that looking to the endurance of the gun rather than the expenditure of powder, the basis of comparison should be *proportionate pressures*. It would scarcely be right to say *equal pressures*, because the thicker gun can fairly be expected to bear a greater strain than the thinner one. Now, the best results obtained from these three guns are as follows:—

The 80-ton gun at Woolwich with a proof-charge of 445 lbs., giving a pressure of 21.5 tons, discharged a projectile weighing 1,728 lbs. with a velocity of 1,657 feet per second—having 32,938 foot-tons stored-up work, or 658.37 foot-tons per inch circumference—equivalent to a penetration of a 32.34 inches plate of wrought iron. The 71-ton gun at Meppen is reported on one occasion, with a charge of 485.1 lbs., giving a pressure on the gun of 20.92 tons, to have discharged a projectile weighing 1,715 lbs. with a velocity of 1,703 feet per second—having therefore 34,489 foot-tons stored-up work, or 697.02 foot-tons per inch circumference—equivalent to the penetration of a plate 33.5 inches thick.

During the public trials in August, the 71-ton gun was not tested so severely, and it is therefore right to class the above in the same category as the Woolwich proof round above mentioned. In August the average weight of the chilled projectiles was 1,712.6 lbs. The firing charge was 452 lbs., the initial velocity was 1,648 feet, the stored-up work 32,241 foot-tons—the work per inch circumference 651.59 foot-tons, equivalent to a penetration of 32.12 inches. The pressure on the bore was 19.85 tons.

The highest result hitherto obtained with the 100-ton gun, of 17.72 inches calibre, has recently been furnished me by Captain Noble; it is as follows:—Charge, 573 lbs.; projectile, 2,000 lbs., about; velocity, 1,725.5 feet; stored-up work, about 41,300 foot-tons, or 742 foot-tons per inch circumference, equivalent to a penetration of nearly 35 inches of armour. The pressure on the bore was 18.0 tons.

It is quite clear, from the above, that the 71-ton gun is a much better weapon than the 80-ton gun, inasmuch as it beats it in every

respect. It fires a heavier projectile with a higher velocity, which has therefore more energy or stored-up work, and an inch and a-half more penetration, and all this is done with less pressure on the bore of the gun. The reason is that it is a better proportioned gun, its main advantage being its greater length. The 100-ton gun compares much more favourably with Krupp's gun, but, nevertheless, would do so better, if its length were greater. The main difference in the guns depends on the difference in the length; and the question naturally arises, how is it that our Government should be now completing and issuing 80-ton guns so inferior in power to Krupp's 71-ton gun, which achieved the results we speak of half a year ago? The answer is, that the guns are designed for the "Inflexible," and that, being muzzle-loaders, the vessel had to be made with portions of the deck corresponding to the length of the gun, to make provision for its loading. All this was determined five or six years ago. Since that time *our own investigations* have shown us the desirability of greatly increasing the length; but the gun being a muzzle-loader, it is impossible to do so. For the ship in question, a muzzle-loader is limited as to its length by inflexible conditions; and all that can be done is, by enlarging the chamber, to utilize to the fullest extent the disproportionate thickness of metal. Circumstances have, in this instance, then, combined so as to bring out the disadvantage of a muzzle-loader in a peculiar way; for we find ourselves, in the case of the "Inflexible," issuing new guns of obsolete proportions for a new ship, with an impatient public wanting to know why our new guns do not beat Krupp's, and that, in spite of the daily papers comparing our proof rounds with the service rounds of Krupp's guns. Apart from this trying instance, however, it is clear that every increase in length is in favour of the breech-loader, because the labour and inconvenience of muzzle-loading increase in an increasing ratio; and, in the case of turret guns, and probably in some guns in casemates and cupolas, muzzle-loading becomes eventually almost impossible.

To pass from this principal experiment to minor ones at Meppen.

Very remarkable results were obtained with smaller guns. An excellent 51-ton 14-inch gun was tried, the behaviour of which closely resembled that of the 71-ton gun, including the method of working, occasional miss-fires, and the like. An 11-inch (28-centimetre) howitzer, a 4.13-inch (10.5-centimetre) siege gun, and a 3.78-inch (9.6-centimetre), were fired, which did well, but need not be here noticed in detail.

A long 5.9-inch (15-centimetre) gun, on a special sea service carriage with oil buffer, gave good results; also an 8.27-inch (21-centimetre) howitzer, and a 5.9-inch (15-centimetre) mortar, were fired at dummy guns in a battery with good effect, notwithstanding that some of the fuzes failed to act.

Two remarkably characteristic guns, 3.4-inch (8.7-centimetre), were fired, fixed on pivots, one with little, and the other with absolutely no provision for recoil. With these is naturally connected another non-recoil arrangement of Krupp's, now well known, consisting of 6.1-inch (15-centimetre) gun, muzzle pivoting, the muzzle

being ball-shaped and working in a socket in an armour-plate. These three guns possess peculiarities deserving of attention.

One piece, 3·4 inches in calibre, Fig. 5, was 14 feet 3 $\frac{1}{4}$  inches long. Its chamber was enlarged to an extraordinary extent, being 5·9 inches

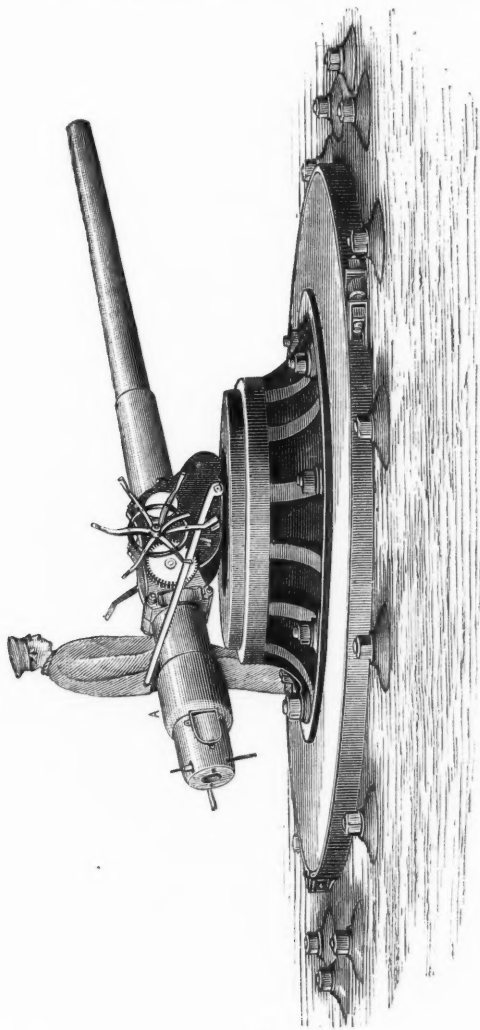


FIG. 5.—Krupp's Long 3·4-in. (87 cm.) Trunnion-Pivoted Gun fixed, without recoil.

in diameter. The cartridge was a long bag, very loose on the powder, made so as to admit of being adjusted in the chamber by hand. The charge was 7·7 lbs. Two kinds of projectiles were fired—long ones, 12·5 inches in length, weighing 22 lbs., and shorter ones, 9·5 inches in length, weighing 15 lbs. The initial velocities of these projectiles were 1,829 and 2,098 feet respectively. The maximum pressure was 11·6 tons. During this extraordinary performance, the gun was held rigidly, being fixed on a strong vertical steel pivot, and so steady was it, that small coins placed on its barrel were not shaken off on firing, except near the muzzle. Eventually a Dutch Officer displayed sufficient confidence to sit astride on the gun while it was fired, with the projectile shooting between his legs at the rate of about 2,000 feet per second.

The second 3·4 gun somewhat resembled the above, but had provision for slight recoil, the pivot moving on its lower end as a centre, the gun forcing the upper end back against a piston or buffer.

The muzzle-pivoting 6·1 gun, Fig. 6, was worked easily, the armour absorbing the shock of recoil, and suffering in no way apparently beyond the structure appearing to spring a little in the earth. A man laid it while riding on a saddle placed on the chase of the piece; he employed sights directed through a small hole at a convenient height above the gun, and he fired the gun himself by pulling the lanyard while still sitting on the piece. This system has been tried by one Government experiment, but has not hitherto found favour. It certainly appears as if a heavy gun so fixed to a shield, and impressing its work on it every round, must soon destroy the structure, but apparently it would take a very long time for a medium gun to do so; and it is possible that a gun so completely protected, and able to fire with such great rapidity, might perform admirable service before it failed in this way, so that, under some conditions, such a gun might be very valuable.

The ball portion of the muzzle can be readily unscrewed, and so can the disc containing the socket into which it fits in the plate. This operation can be safely performed, a shutter being run up, which completely covers the opening from the enemy. It still appears possible, however, that a blow from a very heavy shot might distort and jam the screwed portion of the plate. Against ordinary siege guns such a gun working with all the speed due to non-recoil, and with such an extraordinary measure of security, might effect much.

Two trials against armour took place, one to show the comparative effects of firing against chilled and soft hammered iron structures. As both were manufactured by Herr Krupp, the trial cannot be regarded as a representative one of the system he opposes, and it would be a mistake to discuss it here.

The other was the firing of a 9·45-inch (24-centimetre) gun, with a charge of 165·3 lbs., and a steel projectile weighing 348·3 lbs., at a target consisting of a front 12-inch wrought iron plate, a wood layer of 2 inches, and a back wrought iron plate of 8 inches. The plates were rolled at Dillingen. The shot had a striking velocity of 1,876 feet, which would give 8,492 foot-tons energy or stored-up work, a



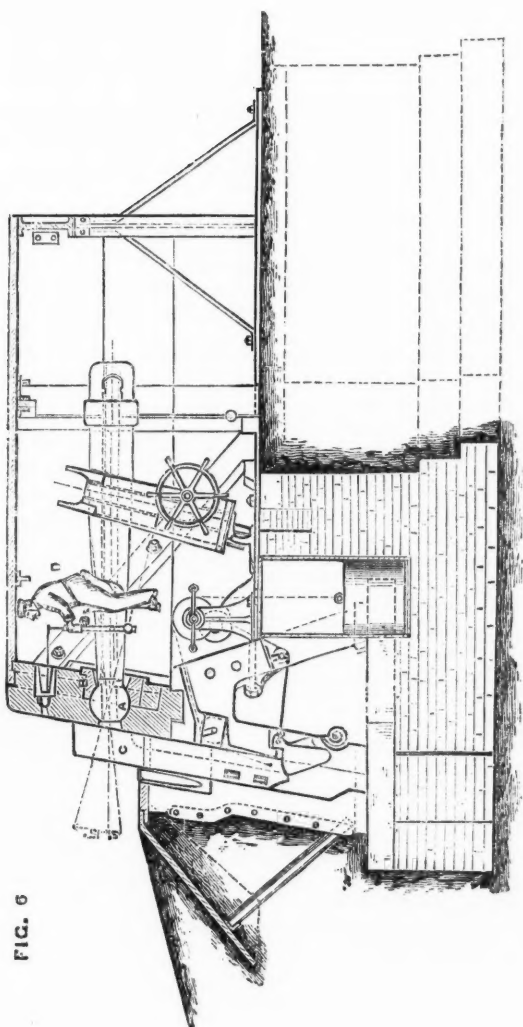


Fig. 6. -- Section of muzzle-pivoting gun in armoured salient fort. A, removable ball-piece, screwed on to muzzle of gun; B, socket disc screwed into shield; C, shutter; D, number laying gun from saddle-seat on chase.

penetrating figure of 288·5 foot-tons per inch circumference, and a penetration of 19·32 inches of iron. The projectile, however, of each of two rounds fired passed completely through the entire 20 inches of iron and grazed about 2,000 metres further up the range. The plates were indifferently rolled, and contained some phosphorus, it is said; but the penetration of the shot was, after making all allowance, extraordinary. They were scarcely deformed in appearance when recovered. The steel was excellent. They had ogival points, the heads being struck with a radius of two diameters.

To sum up, the features which chiefly concern us in these extraordinary trials are :—

1st. The success of the breech-loading system.

2nd. The great results obtained as to power and accuracy of fire.

3rd. The muzzle-pivoting and non-recoil systems.

Although these have been noticed in the short relation already given, one or two words may be useful to lead on to a discussion. First, it must not be supposed that equally good results have not been obtained as to power in this country when guns have been made in accordance with the conditions arrived at by our recent experiments, as may be seen from the following examples. *Two years ago* the new type Elswick 6-inch gun was fired with a charge of 33 lbs. and a projectile of 82 lbs., the initial velocity being 1,902 feet, and total energy 2,057 foot-tons; and in March last the same gun, with a charge of 37·5 lbs., discharged a projectile of 82 lbs. weight with a velocity of 2,031 feet, having 2,362 foot-tons total energy. With this may naturally be compared Krupp's 5·9-inch gun, fired at Meppen *last August*, with 33·1 lbs. charge, and with projectiles weighing 88·2 and 112·5 lbs., giving velocities of 1,835·3 and 1,668·7 feet, and total energy of 2,060 and 2,171 foot-tons respectively. On one occasion it is recorded in Krupp's printed tables as having fired a shot of 69 lbs. weight, with a charge of 37·5 lbs., with a velocity of 2,135·8 feet, having 2,183 foot-tons energy. In these comparisons the Elswick gun has slightly the advantage.

It can scarcely fail to be observed, however, that to rival the results of Krupp, Elswick achievements, not those of Government guns, are instanced. In some measure this may be accounted for by the fact that private manufacturers are untrammelled by routine, and a master of the question at once seizes the lessons taught by experiments, and works them out as he judges best. The Government does not appear to encourage the manufacturing departments to aim at taking the lead in experimental investigation.<sup>1</sup> There are, however, one or two serious lessons that we might learn from foreign trials. Take, for example, the three cases of breech-loading guns, breech-loading small-arm rifles, and prismatic powder. All these have been taken up,

<sup>1</sup> That is, while the Government encourages individual enterprise as in cases of open competition, it does *not* particularly encourage manufacturing departments to enter this field of work. The B.L. small arm competition instanced by Colonel Reilly is a case in point. The competitive shot trial in 1878 furnishes an exception. —C. O. B.

tried, and discarded by us, while they were steadily worked out to a successful issue by Germany.

About 1853 the needle-gun was tried and rejected in England; Prussia, acting on her own judgment, patiently worked on at it, and in 1863 or 1864 the entire superiority of breech-loading arms became indisputably proved, and they were universally adopted. About 1866 we tried prismatic or pellet powder, and rejected it; and after adopting breech-loading guns about 1858, we gradually superseded them about 1866 by muzzle-loading ordnance, and now, after Germany has steadily worked out these questions to a successful issue, we are trying both one and the other again, and those who have weighed the results obtained by them, as compared with those of our own guns and powder, can hardly doubt that both will be eventually adopted. Whether it is that we do not sufficiently resist the pressure of a popular cry, or that we get led astray by the excellence of some individual result, the effect has been that we have not shown the same steadiness and thoroughness in our trials of *matériel* in the instances quoted as Germany.

With the desire to elicit opinions on the points of greatest practical importance, I shall conclude by expressing the conviction that the Meppen trials show that we are placed at a great disadvantage under some conditions by our muzzle-loading system. Until recently, the Italians and ourselves were the main supporters of muzzle-loading guns. These guns were characterized also by being made of wrought iron, which complicates the comparison I now wish to make. Still, the fact remained that England and Italy had *muzzle-loading guns*, of 100 and 80 tons weight, and of a power that no breech-loading ordnance could rival.

The Meppen trials have exhibited a gun which entirely surpasses the last-mentioned piece, and, for its weight, compares well with the former.

Instead of dealing with a theoretical gun existing only on paper, then, we have one in thoroughly good working order, loading and firing by hand, with a rapidity, and shooting with a power and accuracy, far beyond the achievements of the 80-ton gun up to the present time.

This result is not due to a want of knowledge on our part, but to the impossibility of applying our knowledge to the case of the 80-ton gun. With muzzle-loading guns on our present system, we have greater labour in loading, and we have to commit ourselves to the length of our gun three or four years before we bring it into the service.

To argue that breech-loaders should be at once adopted would be to commit the fault I have complained of above, but surely we have sufficient reason to give them a trial, on a large scale. If breech-loaders have the advantages of ease and rapidity in working, of the possibility of changing their length without revolutionizing the surrounding structure of the ship, and of affording greater cover, especially when non-recoil carriages of any kind are employed, they surely deserve a full trial, even at the cost of having both breech and muzzle-loading guns in our service.

Mr. STUART RENDEL: I am perhaps the last individual in the room who ought to presume to rise the first, because I come to it quite unprepared to take any part in this discussion, and have only one remark to make, and it is not at all of a controversial character. It seems to me that in the very interesting lecture to which we have listened, there has been something too much almost of that modesty which belongs to the British Officer. I think the lecturer has hardly given England that position she has earned in artillery science of late. While he assumes to compare English artillery generally with German, he occasionally slips into a perhaps natural forgetfulness of the progress made in one part of England as combined with that made in another. If we are to compare German artillery, whether of Service or of private origin, with our own, let us compare it with English artillery as it emanates from the entire country. I am not here to say that there should be any conflict between the provinces and performances of Elswick and Woolwich, but I say, let them stand together as against any foreign competitor. Naturally, I have listened to all that has been said with a strong sense of what has been done at Elswick as well as with a lively recollection of what has been done at Woolwich, and thus it happens that I note what I think requires your notice also: that this great advance which we are now considering originates wholly with the changed conditions with which artillerists have to deal, which change again originates wholly from investigations into the action of fired gunpowder, which this country initiated and conducted, and for which this country can claim in an especial degree the credit. If a proof be wanted, it is this, that this country was the first to take advantage of the change. It did so in the case of the 100-ton gun. You have heard what the 100-ton gun has accomplished. I have nothing to add to that statement, but I will point out that these things were done by us now long ago. It may be that they were accomplished by Elswick, rather than by Woolwich, because of those difficulties besetting Government manufactories, which the lecturer so clearly indicated. However, let us not forget that they were accomplished by England, and that long ago. Then again it has been, I think, somewhat in the mind of Captain Orde Browne, and it may be in the minds of some here, that we have failed to do as much as we might have done, because we have clung obstinately to muzzle-loading. But it should be remembered to our credit, that the 100-ton gun, which has not yet been surpassed, is a muzzle-loader, and it has been acknowledged by the lecturer, that it compares very favourably with the great Krupp breech-loader constructed long after it. Moreover, the 100-ton gun is actually a service weapon on board ship. Four such guns are now afloat in the Mediterranean. That is an artillery triumph of which I think England may fairly be proud. At the same time, further progress no doubt may render breech-loading more essential. Yet even so, it is known, and should be remembered to-day, that breech-loaders of very considerable power were introduced into this country some years back. I refer to such guns as the 40-ton breech-loader produced at Elswick nearly five years ago. To sum up, what I wish to point out is, that when we talk of artillery, we should confront it not with the artillery from one source alone in this country, but with the artillery which the country can produce generally, and while I say that, I say it without the least assumption that one source in England is better than another. Germany has this remarkable advantage, that while its factory has the invaluable support of very large Government orders, it is also a private factory, and can make large quantities of artillery for other countries, thus adding wide experience to powerful resources. Germany has the advantage of range and resources combined in one factory, they therefore mutually strengthen one another. We distribute them between two, by which much is lost. We have in Woolwich the very great experience which a Government factory can attain through vast and regular order, and in Elswick the greater elasticity, the greater readiness of resource, the greater stimulus, and the less embarrassment by considerations of departmental exigency, which belongs to the private manufactory. But at any rate, let us take together the achievements of both factories when we are contrasting English artillery with German artillery.

Captain BRIDGE, R.N.: I have no observations of my own to offer, but Admiral Hamilton, who has been compelled to leave the room on official business, has asked me to say that, if he had been able to remain until the end of the lecture, he would

have taken this, the first opportunity which has occurred in the presence of an assemblage amongst which are numbers of his brother Officers, to publicly express his thanks to Herr Krupp for the kindness and civility with which he and the naval Officers who accompanied him were received during the trials at Meppen and their visit to his factory at Essen last year.

Colonel REILLY, C.B., R.A. : Reference was made by Captain Orde Browne to the Cunningham gear having been rejected because of the inconvenience of the chains. Now, in the first place, the Cunningham gear was not rejected for that reason ; and, in the next place, I do not see how it affects muzzle-loading or breech-loading, because the shot in many of our batteries goes along to the muzzle by a traveller overhead. Therefore, as far as that goes, it has nothing whatever to do with muzzle-loading. Of course, the whole question with regard to breech-loading and muzzle-loading is the mode of loading the gun, because the results produced, whether the shot comes out of a breech-loading or a muzzle-loading gun, are precisely the same. If you want a certain result, you get it just as well out of a muzzle-loader as a breech-loader. There was a time when people thought it was different, but I am perfectly certain Mr. Rendel will undertake to produce a muzzle-loader that will produce every single result that a breech-loader will produce. I am not advocating either system. I want the best gun to be got for the service. Of course, one would have thought that on board ship was the place for breech-loaders, but the Navy have always had a very strong prejudice against them, and at last the Admiralty has listened to what the Officers of the Navy considered best, as they have to fight the guns. I am rather astounded at Captain Orde Browne, who served so long in the Arsenal, telling us that the Government of this country have been backward in carrying on experiments. It is to me the most astonishing thing I ever heard, because, if you look at the records of the War Office, and of the Committee of which our gallant and distinguished chairman was the head for a long time, I think you will hardly consider that the Government sat still. The extraordinary thing is the number of inventors they have allowed to come forward, and spend the public money. When the Committee was deciding what rifle they would adopt for the Army, I do not know how many were sent in, but at least twenty-seven were allowed to compete. Of course, the natural result was twenty-six out of the twenty-seven hated the Government, for there was only one that could be adopted, and there were hardly any of them such insignificant people but that they could not get some member of Parliament to ventilate their ideas. My friend, Sir William Palliser, does not let the Government sit still, I am sure. He is always ready to point out anything that is wrong, and the very experiment going on at Woolwich now, shows that every suggestion that everybody can bring forward has been tried, but the "Thunderer" gun has not burst yet. Then we go from guns to small arms. Reference has been made to what we have done with small arms, because we refused to adopt one of the very worst breech-loading rifles I ever saw in any service, namely, the German needle-gun. It was the first introduced, and, of course, it did great execution ; but the reason it did great execution was much more in the hands of the gallant men who held the rifle than in the rifle itself. But, however, what I come to is this. When we took it into our heads to go in for breech-loading rifles we adopted the Snider, which was very good indeed, and a great many people think it is good enough still. We at last adopted the Martini-Henry, and when the French were looking out for improvements, they had a committee which sat at Vincennes, and, however unfortunate they may have been in the field, there can be no doubt of this, that their Officers are most scientific men. The French ordnance and line Officers, who were entrusted with this commission, were most laborious in their trials. Their investigations extended over a year and a half, and they have come to the unanimous conclusion that the best military weapon that had been submitted to them was the Martini-Henry rifle in the service of the British Army. So that, you see, we are not so behindhand as might be thought ; we do work along, which I think of immense importance, because we may rush away too quickly in changing our field guns. You know the Prussians had an immense success, and their artillery did great work, but you must remember the great masses of artillery that they collected together, and brought to bear upon the French. They showed a great development of the science and knowledge of moving guns together in the field, and formed immense masses of guns, which had great effect.

At Gravelotte and Mars la Tour they had as many as 150 guns in line at a time, and of course they produced a great effect; but this does not at all prove that that result was obtained because they had breech-loaders. If the Woolwich guns at present in use had been there, I am certain the result would have been as good, and I myself, think better. I can say this, that the Prussian guns did not at all come up to what Prussian Artillery Officers expected of them during the war of 1870. I had the opportunity of going to Berlin, and while there General Walker was kind enough to take me to the different Officers. They showed us all the returns made as to the various guns, and if we ever had an action in which our guns suffered as the Prussian guns did, there would be such a row in this country as would drive all the artillery out of the place. At Orleans, where there was not a very large army, there were 22 guns that became disabled from their own fire. The greatest proof, however, that what I am saying is correct is this, that at the end of 1870 the Prussians discarded the whole of their field artillery, and adopted a new gun. We must not, therefore, worship success too quickly, but must be careful in what we are doing. When I look at that breech arrangement, I ask you, having a gun producing the same result, whether you would not rather do without it in the field, for if it tumbled into deep mud, such as there was in the front of Orleans, into the dongas in Zululand, or into the mud in the Crimea, the result would be very much the same as that which happened to the German guns in front of Orleans.

Mr. LONGSDON: With reference to the remarks of the last speaker as to the Prussians having discarded their gun, I may state that the guns which were said to be defective were those constructed upon the "Wahrendorf" system, and that since the Franco-German War, the German Government has re-modelled the whole of their artillery with guns constructed entirely upon the "Krupp" system, and similar to the field gun, a model of which is on the table.

Commander W. DAWSON, R.N.: The lecturer has placed before us in the most impartial way the very thought which has been in the minds of naval men for a great number of years, namely, that we have in the British gun, taken weight for weight, a gun that gives much the weakest blow as compared with all foreign guns. I was much amused a few months ago to read a laudatory article on artillery in the *Times*, which compared the performance of the British 80-ton muzzle-loader with the 71-ton breech-loader belonging to the Germans. In that article it was stated that, having made certain alterations in the powder chamber, the powder and the rifling of the British gun, the blows struck by these guns were equal. The principal item in making comparisons between guns, is the weight. But that German 71-ton gun had a breech-loading apparatus, which apparatus must add four or five tons to the weight as compared with the muzzle-loader. For purposes of fair comparison of hitting power, you must take that gun as being 66 tons weight as compared with our 80-ton muzzle-loader. Supposing the same hitting power to be developed in these two guns of unequal weight, you have this result, that the British gun is of  $\frac{1}{4}$  less value than the German gun. If I correctly understood Mr. Rendel, he tells us that the 100-ton gun, which is 30 tons heavier, only does as much work as the 66-ton German gun. (Mr. RENDEL: Oh no, not at all. I simply ventured to endorse the valuable remarks of the lecturer.) In any comparison between guns, I take it that the primary item is weight for weight. Colonel Reilly has told us that there is a prejudice on the part of the Navy against breech-loading apparatus; and to this prejudice is due the fact that we have the weakest hitting gun in the world. (Colonel REILLY: I never said anything of the sort.) I understood you to say that there was a naval prejudice against breech-loading guns, and the lecturer says, that it is due to our want of breech-loading apparatus that we have such short weapons, and that this shortness gives us the weakest hitting gun in the world. So far from there being a prejudice on the part of naval Officers against breech-loaders, I believe that the intelligence of the Navy has all been the other way. I will take an Officer who is a fair representative of the intelligence of the Navy, and who has held the highest appointments in connection with the ordnance of the Navy—I mean Admiral Sir Cooper Key—as being an authority who may be looked upon as the spokesman of the intelligence of the Navy in any matter of this kind. I think it is not more than ten or twelve years ago since, as Director of Naval Ordnance, he placed on record in an official document "on the

"requirements in a naval gun," that the Navy would be very glad to get a good and simple breech-loader, and he gave his reasons for that preference. "But," he said in effect, "what we do not want, is a gun that will fire off at both ends. Give us a decent breech-loader, simple in its parts, not liable to get out of order, and that can be trusted, and we would prefer it. We have no objection against breech-loaders in themselves."<sup>1</sup> I take it that the main element of hard hitting by heavy shot of given weight is simply velocity; and that velocity is to be obtained by a better combustion of gunpowder. We have not yet attained to a perfect knowledge of the right way of consuming gunpowder. I am not prepared to say what is the right way; but years ago, in this Institution, and elsewhere, I called attention to the improved combustion which might be obtained by air-spacings, combining several kinds of powder in the same cartridge, and so on. We have been improving our mode of combustion of powder lately, by enlarging the chambers, which is one way of air-spacing; but I do not believe we have yet obtained anything like perfection. We must go on and improve; there is no finality in these matters. It is in that way that the length of the gun tells—in improving the combustion. But there is another matter which has a great deal to do with the velocity of the shot, namely, getting the shot out smoothly and evenly, so that the axis of the shot coincides with the axis of the gun. You will say I am going on an old hobby, but when we adopted the system of French stud rifling in 1865, it was said by the Ordnance Select Committee that that system of rifling gave decidedly the lowest velocities. There can be no dispute now as to why the studded projectiles "gave" "decidedly the lowest velocities," for immediately in front of the seat of the shot in the 7-inch experimental gun, there were a number of cracks and burrs, which showed what the shot was doing in the bore; and how the driving power evolved from the combustion of the powder was used up by the shot, in hammering the bore, and striving to destroy the gun instead of gliding out of the gun with an even motion, and therefore with an increased velocity. The *Times* article, to which I refer, stated that one of the great improvements that had been made in the British 80-ton gun was, that there had been adopted, instead of the "decidedly lowest velocity" stud rifling, what might be called the Bashley Britten expanding base system, by putting on what is otherwise called a gas-check, so as to rotate the shot by that means. The abolition of the stud rifling had a great deal to do with the increased velocity, as well as the enlargement of the powder chamber, which gave better air-spacing; but all that will be of little avail unless the proportions of the gun are improved. There is no question that the longer the gun, other things being equal, the greater will be the velocity; and in this we were only going back to old times, for the ancient guns shown in the Tower are much longer than the present service guns. The Navy has great reason to be thankful that an artillery Officer has at last come forward in this Institution to say what naval Officers have been saying for years, that weight for weight, our ships are provided with the weakest hitting guns in the world. The time has come when a remedy must be applied, and when British guns shall be able to hit a blow quite equal to a German gun of similar weight. I hope that if I have offended anybody in past times in my efforts to call attention to the "decidedly lowest velocities" of studded projectiles, and the weak blows of British guns, they have long ago forgotten and forgiven it. I never said anything against the French rifling of British guns with a view to hurt any man's feelings, but I did so with a view to remedy those weak points to which Captain Orde Browne has now so ably and so impartially called attention. I hope that his plain statements may be more successful than mine were, and that they will result in our getting naval guns which, weight for weight, will do as much work as any foreign gun.

Colonel REILLY: I ought not to have said "the prejudice of the Navy;" I should have said, "the officially recorded opinion of the Director of Naval Ordnance, ten years ago."

The printed official document to which I refer was written by the Director of Naval Ordnance, about the year 1868, but I find that I have mislaid it, so that I am unable to quote the exact words. Another part of the document was quoted by me in "Naval Guns," vol. xvi, R. U. S. I. Journal, p. 353, of 1872.—W. D.



Mr. SCOTT RUSSELL: I should be very ungrateful, Sir, not to thank Captain Orde Browne for what seems to me one of the most valuable of the many papers on artillery, naval and land, which I have had the pleasure to hear in this house. On almost every point which his paper has touched I think he has done good service to the Navy in this country, in which especially, as you know, I am most deeply interested. On the point of muzzle-pivoting, on which he has expressed some valuable convictions and some very wise doubts, I will simply say that that is a question to which I have given the most careful attention, and on which I have made many practical experiments for the last twenty years, for my own instruction. I believe in "muzzle-pivoting." I entirely believe in this wonderfully bold step taken by Krupp; and on each of the points on which doubts have been raised, I feel satisfied that, with prudent foresight, this muzzle-pivoting will be most successfully introduced along with breech-loading into our armoured ships. The manner of its introduction is a serious question, and I quite agree that, if the whole of the arrangements in a ship are not made at her first construction on the distinct understanding that her guns are to be so mounted, and if the whole structure of the ship and the arrangement of the iron plating is not devised for that special purpose, it will be an utter failure. On the other hand, the whole of those arrangements can be so made that large guns can be most successfully used in our men-of-war, and the many advantages of that system, I think, most of you will clearly see. You get rid of complicated carriages, you do not require much room, and altogether you can make a far more efficient man-of-war upon that system than upon any other. I took the trouble, as soon as I heard of the successful experiment, to study carefully how it could be marked out, and I think, when we have the courage to try, first of all, a gunboat, and, secondly, a moderately-sized ship, with these non-recoil muzzle-pivoting breech-loading guns of Krupp's, we shall find that they may be made a great success; but I say, unless great skill is applied to the contrivance of the ship herself, what Captain Orde Browne has said will take place, and a good deal of damage will be done both to the plating and to the ship which carries the plates. In regard to breech-loading, I have merely to say it was my duty, in earlier days, to design the guns for and arm a great many vessels of war, and after my experience I entirely go in favour of breech-loading guns for naval purposes. I am extremely grateful, therefore, to Captain Orde Brown for having the courage to advocate that object in the manly manner that he has here done. I beg to say distinctly that breech-loading has been discouraged, and, if you like, I will say disgraced, in our own service, entirely by our having introduced as breech-loading guns, in the naval service, one of the worst designed, worst constructed, and most dangerous systems of guns that ever was seen on board a ship; and that I say from ample experience, because I have stood beside them while they were being fired, and you all know what has happened in such cases. Those of you who have been to Woolwich have seen, as I have seen, a large field covered with the *débris* of beautiful breech-loading guns, thrown aside as old scrap iron, and I believe sold as such. With regard to slow-burning powder, I think too much attention cannot be paid to that; it is most important. I would also say, do attend carefully to the proper building up of the cartridge; do attend, now that you are adopting breech-loading, to the central fire of that cartridge, to the proper spacing in the inside of the cartridge, and to have the cartridge built up of proper portions, all fitting into each other as they ought to do; and then you will find that, if you cleverly contrive your cartridge, you will get perfectly uniform pressure upon the shot from the first moment to the last in the barrel, and then you will get the greatest possible velocity and the largest possible projectile for the least possible pressure on the inside of the gun, and, therefore, the longer duration of your gun. On all these points, I think this lecture has given us most valuable recommendations and hints. In regard to the proportions of the gun, I venture somewhat to differ from the author of the paper. I think he is rather in favour of a longer gun. Now, I quite agree with a long gun in certain circumstances, and especially if you can have a breech-loader; then a longer gun is convenient in a ship; but, in regard to that point, I would submit to his attention this—comparative proportion. If he will kindly consider how small an increase to the inside of the bore of a gun will give him for a shot of given weight the same initial velocity that he would get by a very considerable addition to the length of a gun, I think he will rather go in



favour of a slightly increased diameter of bore than of a considerably greater length of gun. Allow me merely to say to him that I think a quarter of an inch upon the bore would give him as much more power as two or three feet of additional length to the gun. It is quite a matter of calculation, with regard to any particular case, whether you give the preference to the one or the other. In regard to the shape of the shot, I would merely say there is no doubt that the penetration of the shot itself depends considerably upon that sharp formation of the part of the shot to which he alludes, although I agree with him as to the indications which are given by these cracks and stars of fracture, and what not, of the armour plate; I believe that a plate which yields in folds, like what he calls the weaker plate, not cracks and stars, is the stronger of the two, and with all my experience I find that the tougher and more plastic quality of the metal of the plate is, the more efficient is its resistance to the entrance of the shot; but on the contrary, if the outer skin of the plate can be made conveniently of hard steel, while the part of the plate behind it is made of a tougher material, then the plate will have the double benefit, first, of the high resistance to penetration which the steel gives when it cracks in the form of these stars, and, secondly, that the retarding force of the pliant metal behind will also be turned to good account. I think, therefore, neither the one quality nor the other is a mark of betterness, but that the combination of the two together in one plate is the thing we should always seek for. As to what was said in regard to the introduction of the needle-gun into this country, I am very glad that that was quoted, because I can confirm everything that was said by the author of the paper. He said the needle gun was successfully introduced in a certain year, and almost immediately declined. It so happens that I know all about that. I had to get the needle-gun introduced into this country. I brought the secret to our Government, and I got the needle-gun made for them. I had nothing to do with gunnery; I did it entirely for the service of my country, and for the advantage of the Government of that particular day, and I had a distinguished friend, very high in the Government, who entreated me to go over and get that gun for them. I did so, and I had made in this country a dozen guns, which I presented to the Government. They had them tried; they were found perfect, and what do you think the report was? That the guns were excellent, that they made beautiful practice, that they could fire with astonishing precision and extreme rapidity, but that Her Majesty's Government ought not to have such guns, because they would enable all the soldiers to throw away the whole of their ammunition in three or four minutes, and leave themselves helpless for the future. I leave you to judge how wise, how prudent, and useful a decision that was for a Government to arrive at in England. In regard to breech-loading, in like manner, I would say that the breech-loading of the French was successfully introduced into this country very early, and that, also, was declined by the officials of the Government. I think that the one fact that the arrangements of Krupp enable you to fire such a gun as we have heard of in four minutes is practically to say that one gun of that sort in one of our ships would be as good, and would fire as many shots in a given time, as four of our own construction. After that, let us consider the chances in battle, of a ship armed with that gun and a ship armed with our guns of the same weight. I would call attention to another circumstance. Very admirable criticisms on this paper have been given by an eminent official, and he has told you the great effects which have been produced by certain military guns of certain descriptions. Allow me to say this, that there is a radical difference in the question of muzzle-loading and breech-loading, between small military field guns and large guns used in the armoured ships of modern times, that there is not only no analogy, but an utter opposition, between the conditions of the two. Take a small gun out in the field and take a great gun behind an armour-plate. Is there any analogy whatever between those two conditions of things? There is none; and you will find, in practice, that it is almost as easy for you in the field to get at the muzzle as at the rear of your small gun; and you find, also, that in the field you are just as little protected from shot when you are in the rear as at the muzzle of your small gun; and, therefore, the whole question has nothing whatever to do with small field guns. The question is for great guns not for ships alone, but for land fortresses as well as for sea-going armoured ships; therefore, I must again return my best thanks simply as an

Englishman who cares about his country, who cares to see the artillery of his country better conducted than it has been, who cares to see the Navy of his country well worthy of the sailors of his country. It is on that ground that I feel very grateful to this Officer for the courage and pluck, the energy and judgment, with which he has written this paper.

Major-General S. E. GORDON, R.A., C.B. : Commander Dawson has spoken rather in a disparaging tone of the Woolwich system of rifling. I was comparing lately the practice made with this magnificent gun of Herr Krupp's (the 40 cm. gun) at 2,800 yards, with the practice of our despised 38-ton gun at 3,400 yards; the mean error in deflection of the latter was '6 of a yard, and of the former '78 of a yard. They are both excellent guns, and you cannot say that one gun shoots better than the other; therefore the system of rifling of the Woolwich gun is as good as that of Herr Krupp. With regard to the mean error in range, it is decidedly in favour of the Krupp gun, but that arises from the excellent powder which was used. It evidently shows great uniformity in the charges of powder and that the gun was most carefully laid for elevation. We do not use prismatic powder at present, and I am sorry that it or some other slow-burning powder, has not been introduced. I believe steps are being taken in that direction; but it is a very serious matter for a country like ours, with numerous ships, Colonies, &c., to make a sudden change of this sort, necessitating the introduction of new sights for the guns, new magazine accommodation, &c. Captain Orde Browne spoke of the Cunningham gear, and I believe the objection to its being adopted in our Service was that in training the gun to the right the chain becomes slack on the left; then if you wanted to train it a little over to the left you had to work in the slack chain before you commenced to move the gun to the left. The lecture is entitled "Lessons to be learned from Krupp's 'Meppen Experiments Last Year';" and certainly we saw they had magnificent breech-loading guns, loaded in the most simple and easy manner, showing that such guns can be worked very easily by hand, and I trust shortly we may have guns of the same kind. A lesson which I learnt is, that it is necessary for anyone accepting a similar invitation to that given to witness experiments at Meppen, to have at any rate one of the qualifications said to be necessary to make a good General, viz., "*un bon estomoc*;" if he has not that, I advise him not to go to Meppen, looking at the hospitable, indeed magnificent, manner in which all the Officers assembled were treated—hospitality which I would wish gratefully to acknowledge in the presence of Herr Krupp's agent in London, Mr. Longsdon.

Captain CUSTANCE, R.N. : There was a remark in the paper to the effect that the 80-ton gun was meant for the "Inflexible;" I beg to ask the lecturer whether it is correct that an 80-ton gun will be mounted at Dover, and if so, whether that gun would be of the same length as the 80-ton gun which is intended for the "Inflexible?"

Colonel CLINTON : I wish to add the expression of my admiration of the lecture which has been given to us this day. I rise also to say a very serious omission has been made by a great authority, Mr. Scott Russell, in speaking of the question of breech-loading and muzzle-loading; he has quite left out the question of ramming down the shot, which is a very serious matter in loading a great gun. You must consider the enormous difference that that operation makes, and besides that the gun has to be run in to be loaded. In loading the breech-loader, on the contrary, the men are not exposed, and in every respect it has an immense advantage over the muzzle-loader.

Captain ORDE BROWNE in reply said : In regard to what Mr. Rendel has said on my having stated that the country was generally behind in knowledge, I would call attention to one or two places in the paper where I have said the opposite: for example, "It must not be supposed that equally good results have not been obtained in this country." I have carefully stated that equally good results have been obtained where we have made use of the knowledge we have ourselves found out. And, again, "Since that time our own investigations have shown the desirability of 'greatly increasing the length.'" Therefore I hope I have not in any way implied that *artillery knowledge* in the abstract has been behindhand in this country, but in certain particulars we have not *carried it into practice*. What Mr. Rendel says, of course, is very fair as to the Elswick 100-ton gun having been designed some years ago,

and therefore it stands to a certain extent in the same position as the 80-ton gun, that it is made on the knowledge attained some years ago. The greater increase of length in that Elswick gun compared with its predecessors would in itself be a proof of what I have stated, that it has been our own investigations that have shown the guns require to be made longer. Again, with regard to our being behindhand in construction generally, I mentioned—but I dare say it may not have attracted attention—that it is very remarkable how in most respects the carriages of Krupp's guns are almost the same that you see in the Carriage Department in the Royal Arsenal; therefore we cannot be said to be behindhand in carriages. But what I have endeavoured to show is that Krupp has had the opportunity of bringing these investigations into practice in some ways that has not been done in this country. With regard to what Colonel Reilly told us, I confess I have expressed myself rather strongly now and then with the object of getting what I hope will be valuable opinions, and I have carefully noted down information we have received in the course of the discussion. Colonel Reilly, referring to the Cunningham gear, explained that we had a spouting by which the shot came up to the muzzle, and the matter was therefore easily to be dealt with, whether the chain rose or whether it did not. But unless you could have spouting to convey the men across who have to ram home, it seems to me that the objection still holds good. Of course there is not that objection with the breech-loader, because the whole of the loading is done behind the chain, and the traversing also is done behind the chain. I do not know that the men ever have to go to the muzzle at all in action. With regard to the progress in the especial matter of breech-loaders, I cannot consider that England now has the lead. The Italians and ourselves are the only ones, as far as I know, that have latterly adhered to muzzle-loaders; and the Italians have recently ordered a very large breech-loader of 100 tons. We have, I believe, a small breech-loading non-recoil gun in the bottom of the ditch at Dover: but except that, I really do not know any breech-loader that is at present being tried in the Service. Therefore I cannot see at this moment how it can be maintained that we are taking the lead in breech-loading.

MR. RENDEL: We have in this country a 40-ton breech-loader on the principle of the 100-ton breech-loader now being made, and that has been made something like three years. I beg to repeat I hope that there will be a discrimination between "we" as meaning Woolwich and "we" as meaning England.

Captain ORDE BROWNE: At this moment I am speaking of "we" as meaning Woolwich. I know that 40-ton breech-loader. I have seen it long ago. I was speaking of the Government experiments at this moment. I am glad you corrected me. Mr. Scott Russell made some remarks about the size of the bore and the length, which would require to be gone into in detail. It is a difficult matter, but it seems to me that there is a fair opportunity of carrying it out at this moment, because we have the 80-ton gun with spare strength, so that the chamber can be enlarged, and we have also the 71-ton gun, with greater length. One ought to be able out of those two guns to get something like a comparison. It would be difficult to discuss now the probable difference of effect between a slight increase in the bore and a slight increase in length. With regard to the plate target, I am afraid I did not make myself clear. I did not mean to commend a target for starring, but merely to point out that a projectile has in some sort of way to get through the target. To do so, it must make a hole. Even in the softest wrought iron the way in which it is made is by tearing the wrought iron into a cross opposite where it strikes; then it has to open the hole. If the wrought iron is of a laminated character, it bends back in preference to tearing any more, and the shot gets through; but if the wrought iron is good and well rolled, then the shot has to tear the corners away, which exactly corresponds with the formula in the Artillery Department, which makes the work to be done depend not on the square, but on the first power of the radius or diameter of the projectile. I have been very glad to hear Mr. Scott Russell express approbation of the paper in many respects, but I do not think that there is anything else in his remarks I have to notice.

The CHAIRMAN: The discussion has taken the direction to-day as it is perhaps too apt to do here, rather more of an attack and defence of the Government than seems to me to be strictly the subject before us. We have all learnt a great deal in twenty years, and I can corroborate the statement made by my friend General Gordon,

because I was myself President of the Ordnance Committee at the time that in 1868 we did recommend to the Government a very extensive series of experiments with breech-loaders, but it was our duty to point out that it would certainly cost not less than 10,000*l*. You may suppose no Chancellor of the Exchequer was prepared to admit that estimate, and the consequence was the experiments were not made. Here particularly is the great advantage which attaches to Herr Krupp; and I am particularly pleased to express the great admiration I entertain for the energy, the scientific skill and ability, the extreme liberality, with which that really great mechanician has pursued these experiments in gunnery, the freedom with which he has thrown open his results to the world, and the liberality especially of late years with which he has admitted Officers from every country in Europe to witness his most cherished experiments; a liberality which I trust he is not singular in, for we have also pursued the same policy for a long time. I am happy to have the opportunity of expressing my great admiration for him.

With regard to the particular questions Captain Browne has brought before us, all I can say is, as I have been I believe held up to obloquy in this Institution very often as an advocate of breech-loading, I am not likely now to take any opposite line. We have undoubtedly learned much as to the best method of breech-loading; we have borrowed from the Prussians and the French, and we are borrowing all round. The fact is, to compare the experience of an 80-ton with a 70 or 60-ton gun is futile; there is no comparison between them at all. We are advancing inch by inch, and I affirm most confidently that the last ten years England has been second to none in the race of artillery. Our results in their scientific value, and the degree in which they have been quoted and translated into all languages, will bear comparison with those of any other country. Nor do I blush for the Duke of Somerset, although he made a great mistake when he accepted the Armstrong breech-loader in 1860, for he undoubtedly accepted a very bad form of breech-loading. It was a very admirable gun, and being dazzled by its marvellous results he lost sight of the imperfections attaching to the mode of closing the breech. With regard to our position at the present day there is a field battery of breech-loading guns being prepared at Woolwich. Neither in respect to the experiments which we have been pursuing in regard to the development of the power of gunpowder, the moderation of its impulsive action, obtaining the greatest possible result by increasing the chamber of the gun, the just proportion of the length of the gun to the best effect produced, nor in any other practical matter you can name, is the British Government in any degree behind Herr Krupp or anybody else. I have always been an advocate for breech-loading, and certainly it is not possible to have an application more obviously advantageous than the application of breech-loading to ships' guns. I tremble a little bit at Mr. Scott Russell's proposal to pivot these guns, but he being a shipbuilder knows how to do it, and I should be glad to see the experiment tried.

With regard to the little details of comparison of foot-tons here and there, really those are questions which it is impossible to attach any importance to. The latest experimenter has the advantage of the previous experiments before him, and like buckets in the well, one is always up and another down. We as Englishmen are proud of the Government under which we live, to which we owe the unrivalled blessing which we enjoy of that freedom of discussion which permits us here to be freely discussing and imputing blame to the Government. We must accept with that, some disadvantages, and one of those disadvantages is that in respect to the administration, the executive power, the expenditure of money, there is an extraordinary jealousy of independent action on the part of naval and military officials, and that it is that has caused a great retardation and delay and difficulty in carrying out experiments which all those concerned have known to be very desirable. Public opinion makes sure progress, but it makes slow progress. Ultimately these things come about, and in the long run we are the stronger, the better, and the safer for the prudence of our course. I am sure we may record our most cordial thanks to Captain Orde Browne for his valuable paper.

Friday, March 5, 1880.

THE MOST HONBLE. THE MARQUIS OF LANSDOWNE, &c., &c.,  
in the Chair.

---

MARITIME WARFARE: THE ADAPTATION OF OCEAN  
STEAMERS TO WAR PURPOSES.

By DONALD CURRIE, Esq., C.M.G.

In March, 1877, I had the honour of reading a paper to the members of this Institution upon the importance to the British Empire of a complete system of telegraphs, coaling stations, and graving docks; and your Council has now asked me to deal with questions connected with the adaptation of ocean steamers to war purposes. At first I felt compelled to decline this invitation, partly because of very heavy and pressing engagements claiming the whole of my time, and partly on the ground of the difficulty I might find in treating of matters which would appear to have a personal interest. It appeared to me also that the subject to be opened up was of the utmost national importance and of wide range, and that a more minute study than I could possibly give was required in the elucidation of the points to be brought under review. I have, however, undertaken to put down some observations fitted to draw forth a discussion amongst the eminent men practically acquainted with the subject who now favour me with a hearing; and I can only ask you to bear with me if my remarks are not sufficiently explicit on technical points, or if I may appear to be too general in my statements. It is not easy for a shipowner to discuss arguments bearing upon matters of national importance in which he may be himself concerned, or to elaborate a system in the carrying out of which his own vessels may be required to take a part.

The object of your Council is a national one, intended to advance measures fitted to secure our maritime supremacy, and I count, as I have said, upon your just and calm judgment in the discussion of the subject. We are all interested in this matter, either as naval and military men, or as shipowners, or as individuals taking part in public affairs; and I take the question in hand with no regard whatever to party politics or party feeling, but simply with a view to its bearings upon our Imperial and Colonial interests.

In the three short years which have passed since I wrote the paper already referred to, the world has had an eventful history. Perhaps within no similar period has so much of European and Eastern interest been compressed as in those three years, and the forces brought into play have yet to show their full development. The Eastern question, the African question, the Central Asian question, the Indian Frontier question, have all come to the front for settlement; they are not yet settled, and the final arrangement of these, as well as of the relations of the European Powers to each other, must necessarily be delayed for a certain time, aggravated as the situation is by the large increase in the military and naval forces of Continental Powers. I do not claim prophetic skill; but in that paper I urged that we ought to be prepared, when the occasion should arise, not merely for defence, but for energetic attack; and I pointed out that England, depending upon her naval supremacy, would risk much, unless ready with suitable appliances and possessed of facilities for the combination, supply, equipment, and repair of our fleets. Moreover, I demonstrated that, in the event of war, most likely to occur as far as England was concerned in India, China, or the East, rather than on the Continent of Europe, it would be absolutely necessary to bear in mind the precarious hold we had of our communications with the East and with Australia through the Suez Canal, and that we should look to the alternative route by way of the Cape of Good Hope. I showed the importance to England of our position at the Cape; and that in the Colonies of South Africa there was every indication that we might be involved in a Kafir war. We have had a Kafir war in the Cape Colony; we have had a Zulu war on the Natal borders, which has seriously taxed the energies of the Government: we have been almost at war with Russia; and although a peace has been concluded in South Africa, and the danger of war with Russia is happily averted, South African and Eastern questions are not yet settled. We cannot be free from apprehensions as to the result of the difficulties still to be overcome in Afghanistan and in the East.

If we look to the position of the Continental Powers, is there any assurance to be derived from their mutual relations? Upheavals in Europe; convulsions in Central Asia; complications all round; this is the view to be taken of the position of matters political at the present moment; and in discussing the question of the value of the mercantile marine of this country as an auxiliary to the Royal Navy we have not only to take into account the force in action which may produce war, but we must consider with whom we may have to deal.

Over ten millions of armed men now constitute the military forces of Russia, Germany, France, Austria, and Italy; and, although our insular position may be supposed to protect us from all these or from any single foreign Power, yet we have to ask ourselves these questions—May our Colonies be attacked? May our food supplies be cut off? May the enemy land upon our shores? It is necessary to take into account a possible war with more than one naval Power; although we are now at peace, we may, sooner or later, be at war. Italy itself has steadily increased its power of action upon the sea; France has in-

creased her navy; Germany and Russia are making larger strides in the direction of more powerful naval forces.

At the present moment the Russians have in contemplation an increase to their fleet of cruisers, and have under consideration a greater speed for them than has yet been attained by any of the ships which they have purchased. What does this point to but the destruction of our commerce in a possible war? The sooner, therefore, our commerce becomes alive to the necessity of assisting the Government, and the Government becomes convinced of the propriety of preconcerted arrangement, the better for England's position. The Russians have by their movements in the North Pacific drawn the attention of this country to the forces which they have in that quarter. In January of this year you will remember that two Russian corvettes, the "Ras-boynik" (Brigand), carrying the Commodore's pennant, and the "Nayesdnick" (Jockey) were at Portsmouth, and sailed for China, after being fitted with the new fish torpedoes received from Fiume, such as are now under trial in the "Hecla." These vessels averaged on trial 13 to 15 knots an hour. The Russians also are said to have the intention of employing their cruiser fleet in time of peace in a regular steam service between Odessa and Vladivostock in the North Pacific.

Public attention has lately been called to a lecture delivered at St. Petersburg on the subject of these cruisers, and some interest is attached to the evident friendliness shown by some public men in America in furtherance of Russian plans. In the United States more weight is allowed to the injury the Russian volunteer fleet could inflict upon our commerce than is here attached to it, partly, I dare say, because of their experience of the ravages of the "Alabama;" but in our case the naval authorities would exercise a much stricter vigilance and more vigorous course of proceeding towards these cruisers, than was adopted by the Federal Government. If proper measures had been adopted, they might easily enough have captured the "Alabama," or at any rate have limited her proceedings. One thing is certain, that the Russian programme, in view of war breaking out between their country and ours, is this: to despatch their "Alabamas" to the Eastern and Western Coast of America, and to the China seas, directing their operations with facility by the system of telegraphs united upon Russian territory, not merely from Europe or America, but from the Russian possessions in the north-west of the Pacific.

It is interesting to look at the means which were employed in Russia to raise what they call a volunteer fleet. In Moscow the Governor-General, Prince Dolgorouki, personally addressed himself to the wealthy merchants of that city; he appealed to their fine sensibilities of patriotism, and pointed out that the Emperor would be pleased to have their names laid before him. By that means he obtained sums which, in their calmer moments, the subscribers felt surprised they had ever ventured to promise in the sacred cause of their country. To make up the total sum which such a city as Moscow, ancient capital of All the Russias, should give, the energetic Governor-General had recourse to a gentle pressure of taxation, and received from the merchants the required balance by adding to the guild dues.



This is an illustration of how the volunteer cruisers' fund was raised by the liberal and patriotic exertions of a free people. It is not, however, very important how the Russian volunteer fleet was got up. I dare say one object was to frighten shipowners and commercial men in Great Britain, and thereby to bring pressure on the British Government in relation to questions of foreign policy then being warmly discussed in this country. Whatever the special motive, we are face to face with the necessity of providing against a threatened danger; and if I can show that we may provide with ease against it, we shall have reached one practical point in the argument, namely, whether there can be any adaptation of ocean steamers to war purposes.

And now to enter upon the more special subject of my paper. Speaking generally, merchant steamers, if of suitable speed, will be most useful; (1.) if employed as mail packets in time of war; (2.) as offensive cruisers; (3.) as cruisers on the defensive; (4.) as despatch vessels attached to a squadron or naval station; (5.) as transports; and (6.) as gunboats, or store ships.

First, as mail steamers; in time of war their value will not be second to their usefulness during peace. The telegraph provides instantaneous communication, but the fuller details which correspondence supplies are necessary in the time of conflict, both for Government and commercial purposes. The telegraph, indeed, will be always liable to the risk of destruction; the very first thing the enemy will do, if at war with England, will be to cut our means of telegraphic intercourse, and if we look to the Suez Canal and the Red Sea as the way by which we communicate with China, our Pacific Stations, the Eastern Seas, India, Australia, and Eastern and Southern Africa, we must expect that at any moment, while hostilities are in progress, there will be ever-recurring opportunities for the enemy to inflict upon us the injury which will result from the destruction of the telegraph. Nothing can be more prejudicial to naval and military operations, dependent perhaps upon instantaneous orders from home, or messages from abroad to the authorities in this country, than a sudden and unexpected stoppage of the means of communication. We have now, for example, the cable to South Africa, established as the result of a military disaster, and not as the outcome of deliberate judgment and foresight on the part of the Government or nation, and within the last few days it has twice been broken near the coast of Mozambique, just when the Government were in communication with the Colonial authorities upon matters of the utmost importance to the welfare of South Africa. If, then, the cables can be cut or may be broken by accident, am I wrong in anticipating that during war more than in times of peace the mail steamer is a positive necessity? If a necessity, she should be armed and able to defend herself, and she should be ready to do more, if required, than resist attack.

The wants, however, of commerce have to be supplied; passengers must be conveyed; and the Government service itself has to be met in the conveyance of Officers and men to fill up vacancies; special and important shipments of warlike and other stores and goods have to be forwarded; and the swift mail steamer presents the required means.



These mail steamers, if to be maintained, must be vessels fit to contend with the enemy's cruisers, who will seek to destroy the postal communications with our colonial dependencies; and whether this country decides or does not decide upon the employment of merchant steamers as cruisers (for there is no political objection or international law to prevent it), there is the necessity laid upon the Government to select the best vessels of the mercantile marine for equipment as mail packets, to be fitted in such a way as to be prepared to meet the ships of the enemy.

2nd and 3rd. I take these points together. As cruisers to act offensively and defensively, whether to destroy the enemy's commerce or to assist in the protection of our own, a swift, properly constructed, and well adapted merchant steamer may be most usefully and effectively employed. To be of value, these vessels must have certain qualifications. I will name some of them. Speed is of the first necessity; strength of construction is indispensable; bulkheads must be arranged so as to secure flotation if one or perhaps even two compartments were pierced; in case of fire, the 'tween decks should have separate fireproof divisions; the guns must be placed either on the upper or second deck, sufficiently high above the water to be of service in a sea-way, or sufficiently protected upon the upper deck, and that upper deck will require to be strongly supported against the risk of pressure or recoil. The vital parts of the steamers can be efficiently protected by coal bunkers, with loose thin iron sheets interspersed, as shown by the experiments on the "Oberon," at Portsmouth. The pumping arrangements requisite are very different from those which are generally to be found in merchant ships. The pumping engine should be sufficiently above the water in the event of the fires in the boilers of the ship being put out by a heavy leak. I may venture to say that very few steamers have, in addition to Downton's pumps, adequate steam pumps separate from the circulating pumps of the engine, and which possess the security of having the donkey boilers placed on the main or upper deck.

A great deal more than this is required. The rig of the vessel is to be looked to; the coal burning has to be estimated and taken minutely into consideration. We may look at two steamers of equal tonnage in the same dock; they may be of nearly the same dimensions, and owned by equally respectable owners: they may both be on the Admiralty List; they may each rejoice in the character of being a mail packet; and yet the one vessel will burn, at a 12 knots' speed, 50 tons per day, and the other only 35 tons; both may be the highest class at Lloyd's, but one has only a thin wooden upper deck, quite unfit to carry powerful ordnance, the other has a solid iron deck throughout, adequate to carry ten heavy guns. To outsiders these steamers possess equal advantages, and yet the one vessel could destroy the other in single combat in half an hour, or could protract the struggle until her adversary was rendered helpless by the exhaustion of her coal. In the one case the steamer could carry ten 64-pounders, or even a more powerful gun, with greater penetrating power, such as the Italians have adopted, on the upper deck, with a freeboard of

about 11 feet on a draught of 21 to 22 feet of water; while the other could carry only one or two light guns at all on the upper deck, and would only have 7 to 8 feet of freeboard if her guns were placed upon the main deck. You might put eight guns there, but she could not work them in bad weather.

4. As despatch vessels, swift merchant steamers, such as the China steam clippers of the day, would be extremely valuable in conveying intelligence for the naval or military authorities between home and foreign ports and our naval stations, or for carrying important communications between the Home Authorities and our Officers abroad, or in attendance on a squadron as look-out vessels when off an enemy's port. If two such vessels were attached to a squadron, the Admiral in command could have one on each beam at such a distance as to increase the value of his range of observation. A third steamer a few miles in advance would serve a useful purpose as a naval scout. A double service to the Admiral might thus be secured, namely, if the squadron were cruising at 9 knots, the look-out ships could maintain their position of observation; and if the vessels of the squadron had their fires banked and were under easy steam, the early intelligence which the scouting steamers might convey would give the Admiral time to get up full steam. It would not be necessary to draw in these look-out ships on a clear night to a nearer distance than 8 miles, as it has been practically proved that signal communication by the electric light can be easily carried on at that distance. In no country are there so many merchant ships of this class as in England.

5. You know the value of the merchant ship as a transport, and the late war has shown the effective service which they can render in that capacity. I have seen in two or three wars in which we have been engaged that efficiency, or fitness for the purpose, has not always been sufficiently considered. The relative coal consumption, or the speed, or carrying capacity, or water ballast, or general arrangements, do not enter into the estimate of efficiency; a shilling or two a ton per month has been often thought of primary importance. In one department, the safety provided by bulkheads is said to be all-important for the transport of troops; in another department, economy has to be the order of the day.

6. Although I have spoken of vessels having a speed of over 12 knots an hour as the only useful vessels as cruisers, I do not cast doubt upon the good service which may be obtained from the use of vessels under that speed. It is understood that a very large number of steamers are recorded upon the Admiralty List capable of running at about 10 knots an hour. These vessels would be very useful as transports and as store ships; but a special value attaches to some of these vessels which are of light draught and of moderate depth, with 'tween decks laid fore and aft, so possessing great strength and fitness for river or coast navigation. Thus, where light draught of water has to be considered, as in the Baltic, or in Eastern waters, steamers, specially constructed for strength and subdivided in compartments, now engaged in peaceful commerce, would be invaluable as gunboats, or as store ships, or as tenders to men-of-war.

Now here I would say that the employment of merchant steamers for war cannot do away with the necessity for a full strength in the Navy. There must be, in my opinion, a large and adequate supply, and, indeed, a considerable increase in the number of our cruising men-of-war. There is much misapprehension in the country as to the force in reserve which can be supplied by the mercantile marine. You will be surprised to know that there are not one hundred ocean steamers in this country really suitable for Admiralty requirements, and fit to travel over 12 knots an hour; indeed, I may say there are not eighty. Now, we must be careful not to count too much upon our strength. It is well for us to know exactly what strength we have; the Government, whatever party be in power, have to weigh well not only how many vessels of the mercantile marine may be in existence, but also whether they are all equally worth having and available. I venture to say they are not all equally worth having, and I am quite sure they will not all be available when required. Nearly all the steamers of great speed to which I refer belong to companies carrying the mails. The Peninsular and Oriental Steam Company conveying the mails to Australia, to China, and to India, have a very large fleet of splendid vessels; but they are spread over different parts of the globe. The steamers of the Cunard, White Star, and other lines, are available if their owners could spare them from the Atlantic. The Pacific Steam Navigation Company have their steamers trading round Cape Horn, to Valparaiso and Panama, from which distant parts it would be difficult to gather them when required.

Of other companies I need not speak. You have to deduct from the number I have indicated those vessels which will be out of the way at the moment of a declaration of war, and those which would be unprepared to meet the cruisers of the enemy. You have also to deduct the vessels which may have been sold, and you cannot take into account a large proportion of the fast vessels above referred to, which would still be required for carrying the mails. I estimate that you would not have at the call of the Admiralty in case of need one-third, or even one-fourth, of the whole number; but if you had them all, and if they were suitable for war, there is no arrangement made at the present moment for their being fitted to serve as cruisers. You cannot expect the steamers to be at your disposal unless you arrange in time with those who have charge of them, nor may you count (unless preparations are made in advance) upon the despatch of such steamers to sea fitted for fighting in less than three months after fighting was required. But of what service would they be as fighting cruisers? I know some vessels which have been accepted as up to Admiralty requirements which could not carry the guns one would suppose should be in vessels such as I indicate. They might carry one gun, or, perhaps, two guns, and they could do much injury to the commerce of an enemy; but in doing this, how are they to act with regard to the Treaty of Paris and privateering? Are they to be purchased by the Admiralty and used as men-of-war, chasing and destroying the merchant shipping of an enemy?

Privateering I take to be abolished, but Russia appears to have

established a privateering fleet, manned by Russian naval Officers and crews. I prefer to look upon our merchant cruizers as not employed for purposes of privateering, but by way of assistance to the Royal Navy in keeping up communications with our Colonies, and in acting as cruizers carrying guns in pursuit of the enemy's cruizers. Now, in this we cannot be excelled by any Power in the world. All that the country need wish is that the arrangement should be perfected and held in timely readiness. Shipowners have been asked by the Admiralty to furnish the drawings of their vessels. They have given the authorities all the particulars which are required, and at Whitehall the full details of every suitable steamer are in possession of the officials; and yet, although the shipowners were put to considerable expense in preparing their vessels, and although they were assured that the preference would be given to these vessels, there has been no preference whatever given, and owners have derived no practical advantage from having so prepared their ships. The naval authorities must surely see that it is hardly fair to expect that owners will fit their ships at great expense to be employed in Government service for the good of the country when they are left to infer from recent experience that all they have done will not even be taken into account. At this moment there is no definite principle established upon which steamers are selected for Government service. The Admiralty appear to attach little value to the relative coal-burning of steamers, their carrying capacity, or their speed. I consider that steamship owners should be made aware by definite declaration on the part of the Government of the value they attach to these and other qualities, and on what basis they intend hereafter to charter. If this be admitted, the sooner shipowners know it the better. An Admiralty Minute should be issued for the information and guidance of shipowners. Is it not unreasonable that steamers should have been taken up during the South African War which were not on the Admiralty List, some of them with old-fashioned engines burning coal largely at Government expense, in preference to steamers which had been approved as equal to all Government requirements? I venture to state that it would have been cheaper to the country to have given 30 to 50 per cent. more for such vessels as I have referred to.

I will explain to you what were the first intentions of the naval authorities as to the employment of swift steamers belonging to the mercantile marine.

In December, 1875, the Lords of the Admiralty communicated with the principal steamship owners of Great Britain, asking for information as to their vessels, and explaining that their Lordships were desirous of forming a sound opinion on the practicability of a scheme for supplementing the regular naval forces of the kingdom in the event of any sudden emergency. Their Lordships requested to be supplied with such *data* as would enable them to ascertain and record the capabilities of the vessels owned in this country, and the shipowners were given to understand that the Admiralty meant to take into consideration the time within which such vessels could be adapted for war purposes. In common with other shipowners, I placed

the particulars of our vessels at the disposal of the Admiralty; from time to time they were surveyed carefully, and in due course the Director of Naval Construction was enabled to lay before the Controller of the Admiralty, for the information of their Lordships, the result of the inquiries which had been made. It was decided that no vessel was to be considered of real value for the purpose contemplated, unless able to steam for at least six hours continuously at a speed of 12 knots an hour, as a cruizer; but 10-knot vessels were promised a preference over ordinary steamers for general purposes if on the list. Two guns were considered to be the least armament for protection, and it was laid down as obligatory that proper bulkhead arrangements should be provided, with protection to the machinery above the water-line.

It was clearly apparent to the First Lord of the Admiralty that, with the Declaration of Paris abolishing privateering, trade would pass from the belligerents, as neutrals would have the advantages of communication, and that in all probability the greater number of the swift ships of this country, if we were at war, would have to be taken over by the Government of the day. It was pointed out that a difficulty would occur if the vessels which might be accepted as fulfilling the Admiralty requirements were not under the control of the Admiralty in the event of war, and that it was extremely desirable to offer such inducements as would secure the disposition of these vessels. In some cases it was found that merchant steamers had no adequate arrangements to secure safety for passengers, or for the conveyance of troops, or for a sea fight, many steamers having but few water-tight compartments; but it was admitted that if the water-tight compartments could be provided to such vessels as were not so arranged, the result would be very advantageous. Examination showed that there was a goodly number of steamers of certain well-known companies which were properly divided by bulkheads and water-tight compartments, and that these would adequately perform excellent service in naval operations suited to armed ships of war. The difficulty of providing for the fitting of such vessels in an emergency was foreseen. Some of the Officers of eminence who were consulted judged that it would be impossible to get shipowners to subdivide their vessels if not already provided with water-tight compartments, but as a rule the general opinion held by the naval authorities consulted was to the effect, that in a large number of cases the shipowners of this country would be prepared and willing to place at the disposal of the Government suitable merchant ships fitted for war purposes.

It was then virtually decided that a list should be prepared by the Admiralty of such vessels as were obtainable, and that the list should include vessels capable of steaming at different speeds, some at more than 12 knots, and others at 11 knots, and up to 12 knots an hour. But it was stipulated that vessels should be divided by bulkheads, arranged in such a way as to prevent foundering if any one compartment happened to be filled with water.

The information obtained by the authorities compelled an inquiry into the desirability or necessity of building a larger number of cruising vessels for the Royal Navy. It was admitted that such frigates as

the "Shah" and "Inconstant," or corvettes of the "Bacchante" class, or the armed dispatch vessels "Iris" and "Mercury," with perhaps a dozen other swift cruisers, were all that the Government possessed, and for the estimate of cruising power it was not possible to include ironclads. In comparison, it was known that the French had twelve to fifteen vessels of a speed of from 12 to 14 knots an hour. The question then was whether the Admiralty should add to the effective force of the Navy by the construction of a large number of swift armed Government cruisers, or limit the number of Government vessels to be built, and take into the Service as cruisers swift merchant steamers, to be fitted with torpedoes and for use as rams. The general conclusion arrived at by those connected with the Admiralty who were best entitled to form an opinion, was to the effect that if a high speed could be obtained, merchant steamships might be secured by the payment of some annual subsidy; they would serve special purposes with torpedoes; they could act as powerful cruisers against any privateer or improvised cruiser of the enemy; but it was pressed upon those in power that protection from hostile shot or shell would be desirable.

In 1878 the present First Lord of the Admiralty stated in Parliament that, in the event of war, then considered probable, it was intended to arm thirty merchant steamers as armed cruisers; but nothing was really done; it was left entirely to the moment of the declaration of war, which might be sudden, or to future discussion, whether it was necessary to develop such a scheme for the employment of the mercantile marine. The inquiries of the Admiralty had been elaborately carried out, but nothing was settled or brought to a definite point. Now what I have to say is this: that all these inquiries, the information obtained, the arguments advanced, and the opinions given, have resulted in no practical issue; and my purpose in this paper has been, and is to press upon the country the necessity for a decision one way or the other whether anything is to be done. If the authorities do not carry out some practical plan for making use of the merchant shipping of this country, they will know that they have afforded much information to foreign Powers as to the maritime resources of this country, in the shape of particulars of nearly every steamer possessing speed; for we may be assured that every foreign Government is fully acquainted with the details of the vessels referred to. Are the foreign Governments, then, to have the choice of our steamers? Are they to know all our weak points? Will the British Admiralty do nothing to carry out their own first intentions? While saying this I cannot but pay a tribute to the zeal, energy, and ability of the officials of the Admiralty charged with the collection of information. They have done what they could for the national interest in this matter.

You may say that we need not trouble ourselves with the past, but that I should state what I would propose as a practical plan for the future. Let me, then, submit for your judgment a scheme for the employment of the merchant shipping of this country, and you can say whether or not it is calculated to secure the purpose in view. I will



briefly sketch to you what appears to me to be practical, and of great value. Let the Government select ten, or twenty or thirty steamers (if they can find that number) capable of steaming over 12 knots an hour for twenty-five to fifty days without stopping. Engage these vessels upon some such terms as these:—A payment monthly, or by the year, for their retention; have it an obligation on the owners to retain in their employ men connected with the Royal Naval Reserve. Let the Government keep at certain specified places, such as Ascension, the Falkland Islands, Simon's Bay, Hong Kong, Sydney, Halifax, Bermuda, Vancouver's Island, and other strategical points, a sufficient number of men of the Royal Marine Artillery and Infantry with guns, fittings, magazines, ammunition, torpedoes, &c., to be available when required; prepare the necessary means for arming the vessels retained, and which otherwise would be employed in their regular trades.

Take for illustration Simon's Bay. If one or two of the Cape mail steamers are fixed upon, let their guns be kept at Simon's Bay; on board the vessels, place four leading men as gunners, who will assist to train the crew (all Reserve men), and be ready for emergencies; at Simon's Bay let there be a sufficient number of the Royal Marine Artillery, or of the Royal Marine Infantry, properly trained and ready to embark at an hour's notice. The number of cruisers that will be required will absorb all the Royal Marine Artillery we have for instructional purposes, and also the Royal Marine Light Infantry who may hereafter be instructed in artillery duties. Looking to what France can bring into action, we have not a man too many, in fact, we have not a sufficient number of men for the sudden outbreak of war. Fix with the owners of the ships that these vessels are to be ready at any time to be handed over to the naval authorities at Simon's Bay, there to be fitted and to proceed to cruise off the Cape, or off Cape Horn, or towards Australia, or away in China, or wherever required, in the event of war and the appearance of the enemy's cruisers. The knowledge on the part of foreign Powers that, not merely in home ports, but also abroad, a large number of well equipped, properly manned steamers are at hand and available for the defence of our commerce, and as auxiliaries to the Royal Navy, would paralyse such efforts as have been made by the Russian Government for the equipment of the cruisers which they can control.

But look at the value such a plan as this would be to the mercantile interests of Great Britain itself, and the confidence it would inspire. The cost would be trifling as a means of maintaining a number of such vessels; it would add a splendid fighting power to our naval resources, as far as men are concerned; and on this latter point you should consider that, upon war breaking out, the Admiralty would have difficulty in manning all the ships of the Royal Navy, or indeed, even a large portion of them. I am sure this contingency should be looked to. The number of the Naval Reserve in 1879 was only 12,000 of the First Class, and 4,962 of the Second Class.

The number of our merchant seamen has not increased very materially in the last twenty-five years. In 1851 we had 136,144 British seamen, in 1878 the number was 172,242. But the foreign element in

our ships increased in a much larger proportion; in 1851 there were 5,793 foreign sailors in our merchant ships, in 1878 there were 23,343. Now consider this, looking at the increase in the tonnage of the United Kingdom and the Colonies. In 1851 we had 3,337,546 tons of sailing ships, in 1878 4,178,789 tons. But the steam tonnage had increased in a far greater proportion; in 1851 we had 167,398 tons, and in 1878, 2,313,332 tons. It is extremely interesting to look for a moment at the tonnage in British possessions. In 1851 there were of sailing ships 707,785 tons, in 1878, 1,659,355 tons. The steam tonnage belonging to British possessions in 1851 was 20,233 tons, in 1878 it had increased to 178,995 tons.

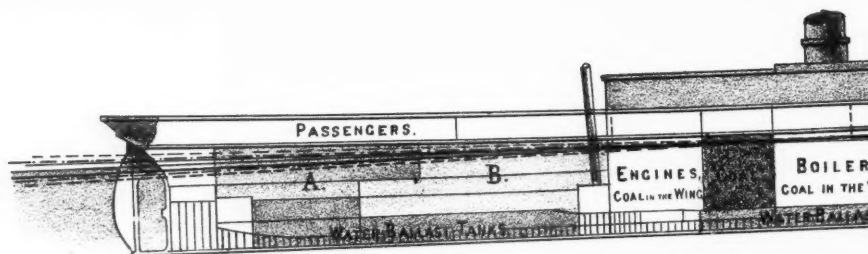
What reason is there to suppose that shipowners would object to a reasonable arrangement, or that the Captains and crews of merchant ships, supplemented by properly qualified naval Officers and gunners, and adequately supplied with war materials, would fail to give a good account of any cruiser of a similar character belonging to a rival naval Power? At the attack upon the forts of Sebastopol there was no manifestation of fear on the part of hired transports which I might name, whose Captains stood upon the decks while manœuvring to assist in case of need the vessels of the British Fleet closely engaged in action. In the American War, the blockade runners—employed, I admit, in a doubtful service—gave evidence of a daring and a resource which has added to, instead of detracting from, the renown of British seamanship. An immense additional advantage by way of strength to the Royal Navy, and to our maritime power, would be drawn from this union of the mercantile marine with the Royal Navy in the event of war. At present there is so much jealousy between the services that naval Officers cannot get employment in merchant shipping to the extent to which their merits entitle them. The Captain or Officer of a merchant ship has no chance of joining the Navy; but this interchangeableness or harmony of action would engender such feelings of mutual sympathy and support as would present a power of vital energy and patriotic vigour such as Russia, France, or Germany can never be expected to display.

Such an employment of our Auxiliary Force would secure occupation to worthy and able naval Officers. Each steam company, whose steamers were engaged by Government, would require Officers, and the Admiralty would also be compelled to avail themselves of their services. I have often heard with regret able Officers of the Navy, who are anxious for work, lament their constrained idleness. Some such employment as I have just indicated would afford them opportunities for active and useful exertion, and the extra cost to the country would not be equal to the cost of wear and tear of a small ship of war. I see another advantage in the regular employment of naval Officers in connection with the merchant service, namely, the experience which such Officers would gain. At present an Officer on half-pay may have been for a long time ashore, and suddenly finds himself appointed to a position which he has the right, but not the experience and knowledge, to fill. The same remark applies in some degree to engineers.

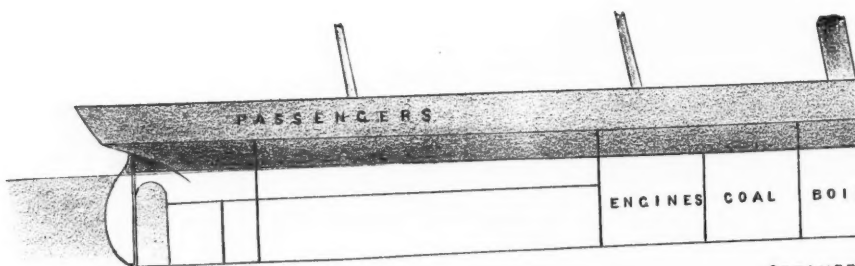




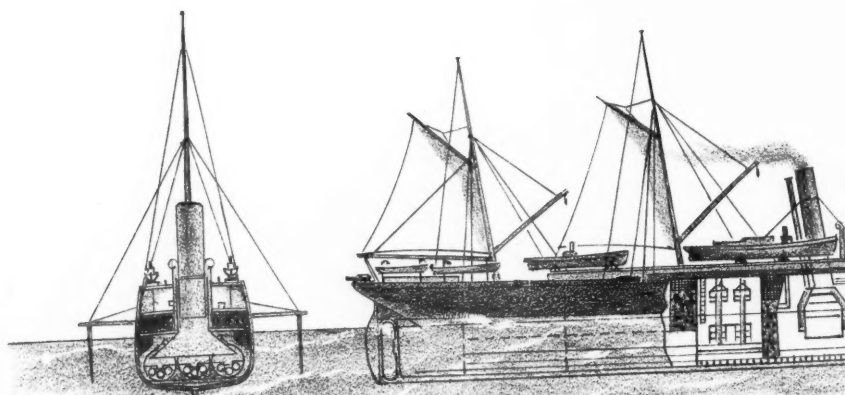
STEAMER A.



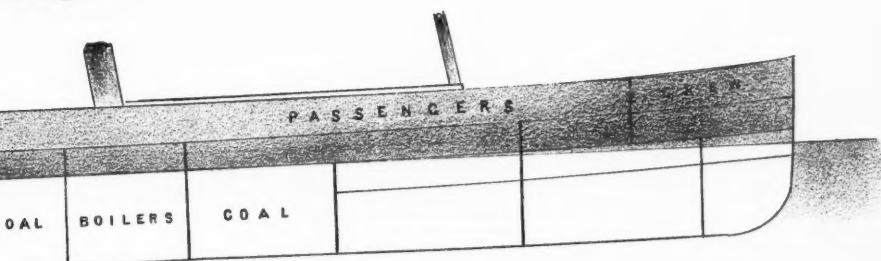
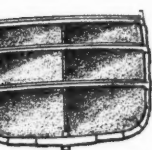
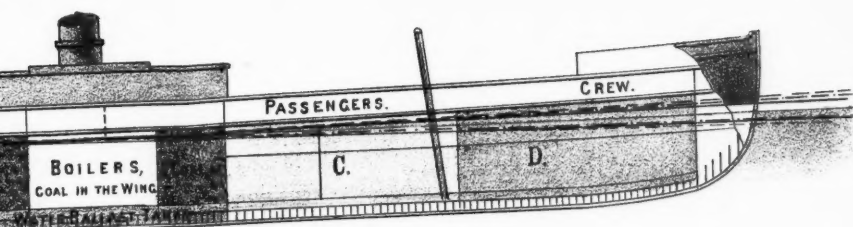
STEAMER A.



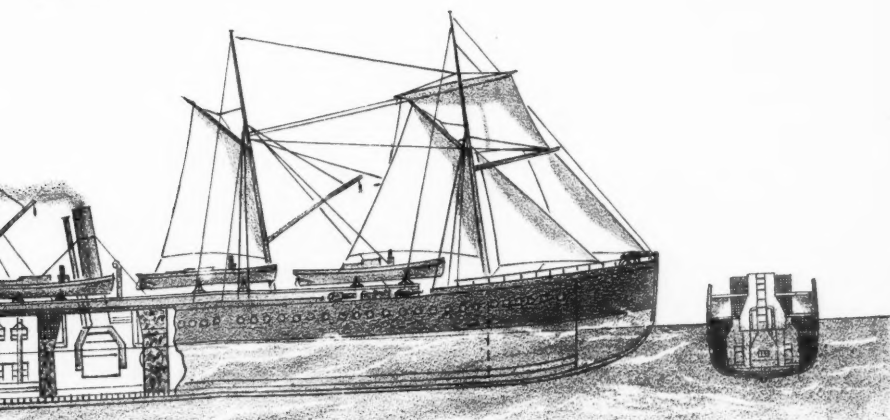
STEAMER



STEAMER A.

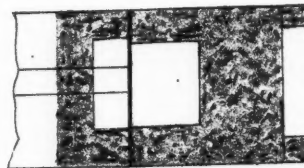
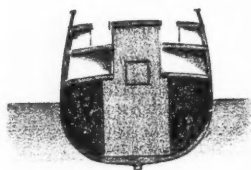
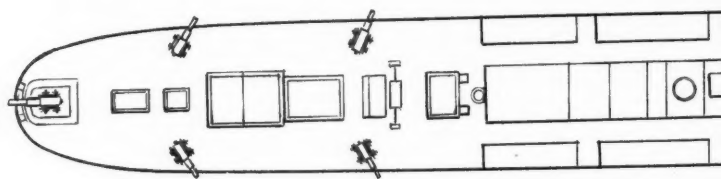
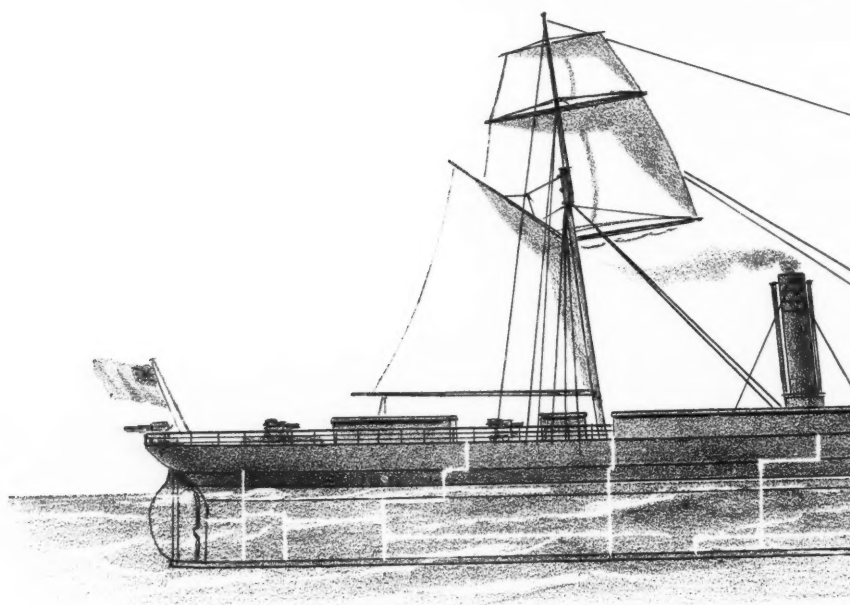


STEAMER B.



M. S. HECLA.

STEAMER







If there be one thing more surprising than another in relation to our arrangements for a possible war, and the probable closing up of the Suez Canal, it is the absence of a graving dock at Simon's Bay. I would urge that Government docks should be established for Government account at every one of the important strategical points of our widespread Empire. But beyond question Simon's Bay, half-way as it is to Australia and the East, should have a naval dockyard and graving dock suited to the repair of our largest men-of-war. At Capetown the authorities are building a graving dock; but a commercial dock will not serve the purpose of the Royal Navy in the case of war, and the South African station, commanding important sea routes towards South America, as well as towards Australia, India, and the East, claims the earliest attention at the hands of the Government, who ought to ask Parliament at once for the necessary funds for the construction of a graving dock. Is not this important when you remember that between Plymouth and Melbourne or Sydney there is no graving dock in existence for our men-of-war? We had only three men-of-war on the South African coast during the hostilities in that quarter, and two of them, the "Active" and the "Tenedos," having run ashore, had no place where they could be repaired. What would happen if a naval combat should take place off the Cape Colony resulting in the injury of our ironclads or cruizers? and how can we expect these vessels to have the requisite speed if their bottoms are not painted at regular intervals? This is of importance in view of the possible employment of merchant ships as cruizers, none of them being constructed of wood. A heavy ironclad would be unable to enter Capetown docks.

It is useless to think of employing merchant steamers in war, unless we take the supply of coal into account. It is necessary that the coaling stations for our fleets should be fortified. They are not fortified at present, but they should be. The point under immediate consideration, however, is not so much the fortification as the question of the supply of coal—where we are to get the coal if coal should happen to be declared contraband of war? Between England and the Cape two coaling stations at Madeira and the Cape de Verde Islands are in the hands of the Portuguese. Certainly, an enemy's cruiser would have less hope of supplying her exhausted stock in the South Atlantic than we would have, for we could arrange to have coal at St. Helena, or Ascension, or at the Gold Coast. The coal question, in fact, is one of the highest importance, and once it is fixed where the coaling stations throughout the world should be, their fortification must be decided upon as of necessity. The coal must be at strategical points. There are certain admitted bases for the operation of the Navy in the event of war. Bombay, Aden, and Ceylon for our Indian possessions; Jamaica and another island for the West Indies; Halifax and Bermuda for our North American station; Simon's Bay, in South Africa; Singapore and Hong Kong in the East; the Fiji Islands and Vancouver's Island in the Pacific; and the Falkland Islands in the South Atlantic, as guarding the route round Cape Horn. To illustrate this, I may be allowed to refer to the detention which occurred at St. Vincent,



where the cavalry transports sent from this country after the news of Isandula were delayed seven or eight days for their supply of coal. The consequence of the delay was serious to the expeditionary force, and we will do well to take lessons from such misadventures as occurred at St. Vincent. Some of the vessels which were engaged had common, not compound, engines, and consequently burned 70 to 90 tons of coal a-day, at Government expense of course; but the cost I do not look at as of so much importance in the present argument. The delay which took place was serious, and might have been disastrous in its results. If the Government knew in advance the actual coal burning, and in other respects the real state of effectiveness of steamers belonging to the mercantile marine, there would be no risk of such delays as occurred at St. Vincent through this cause.

I have had prepared some drawings to show the arrangement of guns which might be placed in cruisers taken from the merchant service, and I ask your indulgence while I illustrate the relative efficiency in two types of good mail steamers. By way of illustration of the general question, I will compare a steamship, marked on the plan as A, in its power to contend with another merchant steamer marked on the plan as B. I will go farther and examine to what extent such a vessel as A may contest an action with an enemy's cruiser, even if the latter be equal to the swift armoured ships of Her Majesty's Navy. The steamers A and B are of equal tonnage, and both are employed in carrying mails, passengers, and cargo. One or two of the Russian cruisers—the "*Cimbria*," formerly in the German-American trade, for example—is somewhat the same style of ship as B.

The steamer A can carry ten heavy rifled guns (the 64-pounder of 64 cwt., which has a piercing power of 6 inches at 200 yards) on her upper deck, which is of iron covered with teak; the frames are carried up to the upper deck, and are 2 feet apart. The steamer B cannot carry heavy guns on her upper deck, which is of pine 3 inches thick, with fore and aft plate iron stringers only 2 feet or so wide. She must carry guns on the second deck, and her frames are 4 feet apart above that deck. The depth of hold in the steamer A is 30 feet, that of the main hold in B is 27 feet. If both ships are loaded to 22 feet draught of water, A will have  $10\frac{1}{2}$  feet of freeboard for the guns, and B will have only 7 feet. You can estimate the difference of effectiveness in a heavy sea. The ship B might carry guns of a small calibre, but not ten powerful guns. In speed the ship A excels the other a knot or two an hour with only 10 tons more consumption of coal. The ship A is rigged so as to be manageable under sail, and, being under nine times her beam, can manœuvre more readily than the vessel B, which is ten times her own beam. The strength of the upper deck of ship A would enable her to carry two torpedo-boats of the second class now in use in the Navy; also the new 48 feet lifeboat steam pinnace, which is also used in the Government service as a torpedo-boat; but the ship B could not, without important alterations, carry any such boats. These steam-pinnace torpedo-boats, built by White, of Cowes, steam 13 knots; the weight of each boat is 8 tons, including engine and spare gear, not coal (of which she

can carry 2 tons); they are diagonal-built, of two three-eighth inch thicknesses of mahogany, with 15 inches of air space the whole length of the boat, and a separate compartment fore and aft. They have the advantage over the steel boats in being easily repaired and got ready for service if injured. The late accident to the "Hecla's" steel torpedo-boats proves how quickly they can be rendered unserviceable. In a naval engagement the cruiser would have a powerful assistance from one of these pinnaces lowered into the water during an action.

Along the whole of the second passenger, or gun deck, there is no bulkhead in the ship B for the case of fire: the ship A has seven bulkheads on that deck. The pumping arrangements of these two vessels, as I have already indicated, are different; in A you have auxiliary boiler power above the-water line, and consequently available if the fires under the main boilers are extinguished; in B the donkey boiler is in the engine room, and all fires are on the same level. Now, if these two steamers were offered to the Admiralty for charter by their respective owners, their fighting value, or ability to keep afloat, would not be taken into account, any more than their coal burning. As for fighting qualities, bulkhead arrangements, or ability to cope with or escape from an enemy's cruiser, that never has been taken into consideration, although shipowners, as I have already said, were led to believe that the Admiralty desire the special qualities mentioned, and have urged shipowners to provide them.

Let us look at the ship A in combat with such vessels as the "Volage," the "Mercury," and the "Hecla," all of Her Majesty's Navy. If we take the "Volage" class we find a capacity to steam 14 or 15 knots at full speed, carrying only  $3\frac{1}{2}$  days' consumption of coal; the ship A for 12 knots' speed can carry 55 days' coal, for 13 knots, 48 days' coal, and for 14 knots, 40 days' coal, with space for a battalion of troops, and with full supply of ammunition for her ten heavy guns. The "Volage" has eighteen guns; she has no armour. You can judge whether the "Volage" is so very much superior if you take into account the inability to remain at sea away from a coal station. She is fully rigged and can cruise under sail, but in all probability she would be encountered on a cruise by ship A at a great disadvantage, for she would require to have her fires banked when at sea on a cruise, and this means consumption of coal, and her supply is limited. I think ship A could steam at the same speed 1,000 miles with the same quantity of coal as the "Volage" would burn in getting over 350 miles.

Then there is the "Mercury," a steel twin-screw corvette. She can stow 750 tons of coal, and her speed on trial was 18 knots, burning about 200 tons per day. That is to say she might go full speed for a little over three days. In a fight with the ship A she would manoeuvre well with twin-screws, but she can carry no heavier guns; she carries the same armament as I venture to allow to the ship A. The "Mercury" and her sister ship the "Iris," cannot be handled with advantage under sail; they have small sail-power, and, indeed, I question if they would steer at all, as they have to drag their two screws.

Let us take the "Hecla," supposed to be a type of the ordinary merchant ship. She is long, and draws much water; her speed is under 12 knots at sea; and she carries only five 64-pounders and one 40-pounder Armstrong gun. Owing to her great length in proportion to her beam she cannot manœuvre in narrow waters, or turn quickly. On the principle of carrying all our eggs in one basket, she is fitted to carry for the fleet six torpedo-boats. I set her aside, as at present arranged, as of no great value in a fight on the high seas with a swifter opponent. As a cruiser she has not sufficient speed. The "Hecla" has on board mining stores for either the defence of harbours or to be employed as counter-mines for the destruction of an enemy's mines; also a large quantity of electric cables stowed away in tanks. But she is the only vessel in Her Majesty's Navy so fitted.

In estimating the value of merchant steamers for war purposes, we must not overlook the protection to vital parts secured by coal. It would be easy to improvise protection along the sides of the engines or boilers by cotton bales or coal; and if we take coal, the experiments in the "Oberon" already referred to are instructive. The powerful 7-inch 90-cwt. gun, placed only 150 yards from the coal armour which was stowed on board the "Oberon," failed to perforate the bunker. The heaviest charge of powder allowed for such a gun was used, as well as the heaviest bursting charge for the shell. The projectiles penetrated to depths varying from 3 to 8 feet; but in no case did either shot or shell get through into the ship, nor was the ship injured or the coal set on fire by the shells bursting in the coal; and with the exception of small holes in the skin plating made by the entering projectiles, there was no apparent damage done to the ship; so that had there been machinery behind this bunker it would have been as free to work after the heavy round of firing as at the commencement of the mock action. In the action between the unarmoured vessels "Kearsage" and "Alabama," the former managed successfully to protect her sides by chain cables. If we take the fight between the "Huascar" and the "Shah," it is a marvel that the latter vessel, which was unarmoured, escaped destruction.

I throw out these suggestions for your consideration. I admit at once that a larger study might have produced for you a more fruitful gathering of *data* and of argument. It may be, and I trust it will be, the means of drawing the attention of the public and the authorities to the matter, so as to secure a thorough investigation of the subject. We have, as a people, our fits and starts in respect of the reform of our naval and military administration. Some will say, "Why raise these questions; we have gone on well hitherto." Others will say, "Build more ironclads and more cruisers, and let the mercantile marine alone." I trust this question may not be made a party question, or one of economy merely. Economy is a very good thing, but there is also an "ignorant impatience" of taxation. There is more than that—there is an impatience of the duty of national effort. This country does not object to pay for an efficient Navy, the right arm of the country; if fully persuaded of the necessity, there would be no refusal to supply adequate means. What the

country objects to under all administrations is the ineffective use of means to secure the national purpose in defence and in readiness for war; and it is as patriotic to urge for the necessary expenditure as it may be popular to clamour for a reduction of the burdens upon the people of the country. I am now treading on delicate ground. One great and permanent difficulty in the way of a comprehensive, effective, and consequently really economical arrangement for the expenditure in our Army and Navy, is the change, according to the present constitution of the War Office and the Admiralty, in the directing power with each new Administration. I am not sure that we might not be more efficient with permanent Officers, charged with the practical oversight of our national forces. This is a matter which concerns the mercantile marine as well as the Navy. I might ask if you remember the discussion with regard to the efficiency of the Navy opened up by the late Mr. Ward Hunt, when he became First Lord of the Admiralty, who declared in Parliament that out of 41 sea-going ironclads, of which 5 were building, only 18 could be considered effective at that time, and that only 9 out of 14 coast defence ships were fit for sea.

I may here refer to the appointment of a Commission, which is now sitting, to inquire into the best means of providing for the defence of our Colonies. The specific objects to be considered are, the condition and sufficiency of the means, both naval and military, available for the protection of the more important seaports within our colonial possessions and their dependencies, and of the stations suitable for coaling, refitting, or repairing our men-of-war. The Commission is also charged with the duty of suggesting such measures as may seem necessary to provide for the protection of the commercial interests of the whole Empire. The task is a highly important one, and the distinguished men who are charged with the duty of this inquiry will be well entitled to the gratitude of the country if they can practically secure the due consideration of the means to be employed in the national interest.

The questions to be opened up by the evidence and discussion are of far reaching scope, and must be embarrassing, for we have yet to formulate a colonial policy in harmony with Imperial interests and aims. Am I not right in stating that the Colonial question is of as much importance to us as any questions affecting Turkey? and this Colonial question is still unsolved, nay, I may say, still even unconsidered. The people of this country never turn their attention in good time to questions of policy. Our leaders of public opinion, the statesmen who should make national welfare and development their study, very often think more of party successes than of working out in harmonious concert the best national policy. I am satisfied that in the course of time the Colonial question, the question of an Imperial federation to unite in one compact mass the people of British race who are spread over the globe, has yet to show itself as a force to be estimated and employed. It may be remembered by some who hear me that not many years ago, when it was considered by certain politicians to be an open question whether we should hold our Colonies or not, the public feeling in Australia took the shape of inquiring

whether in that distant part of the world it might not be as well to be free from a connection with Great Britain which, in the threatenings of war at that period, left them in doubt whether the Imperial forces could be spared to help them, in fact, whether they had not to expect that they would be left to defend themselves in a struggle which they had in no manner assisted to provoke.

In the paper which I read before you three years ago, I used these words with reference to the question of colonial defence: "Looking to the wide-spread dominions of England, and to the growth of opinion favourable to a closer union between the Colonies and the mother country, could it not be possible to arrange in advance for combined action in the event of war? Might not each Colony, according to its importance or ability, have its own guard ships or defence vessels, fitted at a given moment to combine with the Imperial ship or squadron near its coast, or even to join in a larger enterprise?" In the Colonies there might easily be organized a powerful reserve of Officers and men for naval service. The Colonies might also join the mother country in the cost of colonial defence.

In due course we shall know what the Royal Commission on Colonial Defences will report. At the same time I might ask why the country has had to wait until now for the appointment of such a Commission to consider the questions of colonial defence, coal stations, &c., which we discussed here together in March, 1877, and which have for years been pressed upon the country. This is not a party question. We have our national honour to defend and uphold; the defence of our Colonial Empire is at stake; the food supplies for our population have to be secured; our maritime and commercial wealth and standing have to be maintained. How are we to secure these, and the blessings which we enjoy in our free institutions, if we do not recognise our national responsibility and take adequate and timely means to defend and maintain our position?

What country was considered better prepared for all eventualities than France before the war with Prussia? And what an awakening when, as the result of the terrible conflict, we saw a humiliated and dismembered country under the dictation of a victorious people whom the war united and made a nation. The people of this country may well lay the lesson to heart. The lives lost to France, the value you may care to attach to Alsace and Lorraine, we are unable to estimate; but one thing in the financial calculation of the Franco-German War will come home to us as a practical people. That is to say, apart altogether from the enormous penalty which the conqueror claimed and exacted (over 220,000,000*l.* sterling), there was as much cost to France in the shape of indemnities to the departments which suffered by the invasion as the whole naval and military operations had entailed upon the country. I do not say this country will be invaded, but the contingency is not an impossibility; any of our dependencies may be attacked and may suffer enormous injury. It has been estimated that France lost not less than 1,000,000,000*l.* sterling one way or another by the German war, and the annual charges on the Budget have been increased by 25,000,000*l.* sterling. We have suffered no such defeat as the French,

but we have had our warnings, and we cannot be free from the responsibility and the dangers attaching to our extended Empire. It is for this country to make suitable arrangements in time to protect our dominions both at home and abroad, and this can only be secured by a comprehensive union of our national forces, and of these not the least is the British mercantile marine.

Emergencies will suddenly arise; some question or other will call for sacrifices or settlement. I am satisfied that when the time of danger comes, the mercantile marine of this country, judiciously employed, will have the spirit to respond, as it has the power to be equal, to any claim which may be made upon it; and it may be that to-day we have assisted together in the furtherance of a practical and useful examination of our resources in a suitable adaptation of our mercantile fleet to purposes of war.

Admiral Sir WILLIAM KING HALL, K.C.B.: This is no new subject to me, for I had the pleasure of supporting Mr. Currie in this theatre three years ago. Having served at the Cape of Good Hope, I recognised the absolute necessity for more dock accommodation, and I believe that this country is greatly deficient in docks. Mr. Currie has stated that there is no dock between Plymouth and Melbourne or Sydney. There was a Dock Committee fifteen years ago in the House of Commons; I wrote to that Committee to point out a place at Falmouth, Carclase Point, near St. Just Pool, available for a dock, where there are 4 fathoms of low water at spring-tide, the most western port of our land, ready either for disabled ships to come to, or for outward-bound ships to depart from. I also, when Admiral Superintendent of Devonport Dockyard, wrote an official letter as to the difficulties in war time from want of docks, &c. I will now read portions of that letter.

"I propose that all companies having Government mail contracts should enter their crews for three years, and that all their Officers should remain for six months, which would afford the Government time to appoint their own Officers, should it be desirable. Government to grant pensions to those who might become disabled. For example, any man losing a limb, or becoming crippled whilst in the mail service, should receive a pension, as an inducement for the best seamen in the nation to enter; that nine years' service in Government contract vessels, and three years in a ship of war as able seaman, with a very good character, should entitle him to 8*l.* or 10*l.* a year, and his services should be available in the event of war. Thus twelve years of the best of a man's life would be at the service of the country, a fair amount of force always afloat, without the cost of victualling. Greenwich Hospital to be open for them in old age.

"That the vessels be fitted for guns, with 100 rounds per gun, and have them on board. All to be in charge of a gunner's mate, paid and victualled by the Crown. Once in six months the guns should be exercised and inspected by a gunnery Officer. An annual promotion to the rank of gunner as an incentive to the gunner's mates.

"All other incorporated companies should have guns appropriated and bull rings if necessary, fitted, and the stores kept at their wharves, and mounted once in six months.

"A sudden declaration of war, instead of creating a panic, would enable us in our strength to annihilate at a blow the Power or Powers opposed to us. Commanders-in-Chief abroad would find a well-manned force at their disposal, protecting our commerce, and destroying the enemy's."

This was written twenty-eight years ago, when I was Captain of the "Styx," during the Kaffir War, before the Continuous Service or Naval Reserve were established. We want to rise above party considerations, and to get the country to believe in the necessity for a strong Navy, and that this Navy wants docks. The building of iron-clads was commenced by Louis Napoleon plating his ships with 4-inch armour. Well, you advance to 8 or 10 inches, that is plating with silver; you go on to 14 or



16-inch layers, that is plating with gold; you invent a torpedo, which costs 100*l.*, and you send that ship to the bottom. It takes years to build these immense vessels, and their cost is so tremendous, that I should scarcely like to run any risk with them. I would not care to chase an enemy much in shore in a ship worth a million of money which, if lost, would require seven years to be replaced. We want in place of these ironclads a host of gunboats and coasting vessels. Denmark, in the old wars, relied upon her gunboats. Let me give you a bit of history, when in 1808 the Treaty of Tilsit armed everybody against us. See what our glorious ancestors did. Here is the King's speech in that year: "We are commanded "by His Majesty to inform you that no sooner had the result of the negotiations of Tilsit confirmed the influence of the control of France over the Powers of the Continent, than His Majesty was apprised of the intention of the enemy to "combine those Powers in a general maritime confederacy to be directed to the uniform subjugation of this kingdom, or imposing on us an ignominious peace."<sup>1</sup> We had against us France, Denmark, Portugal, Russia, Austria, Prussia, and our old friends the Turks. What took place? Ninety pennants and 30,000 troops within six weeks started for Denmark, bringing back their fleet, while another squadron convoyed the Portuguese fleet over to the Brazils, and at that same moment we were forcing the Dardanelles. But what would we do now, in such circumstances? The population at that time was 13,000,000; now we have 34,000,000, and our Colonies. Another step taken by England was to issue letters of marque. By the Treaty of Paris the right arm of England has been destroyed. The reply to the King's speech, from which I have quoted, was carried in both Houses *without* a division, and why? Because in both Houses they had naval Officers to guide them, whose opinions were respected; they had twenty-one Admirals and Captains in the Commons, and fourteen in the Lords. We had 30,000 of the best seamen in England in these letters of marque. What we want is a fleet of gunboats. I do not believe that Treaties are worth any more than the paper they are written on. In 1839, when I was in the "*Benbow*," with Sir John Hay, we had an economical Admiralty, and they thought it well to have peace complements for the ships, and so they took a hundred men out of each line-of-battle ship. What happened in the Mediterranean? There were twenty-five sailing line-of-battle ships belonging to the Egyptians, which the Turks turned over to them in Alexandria, and there were three English line-of-battle ships keeping them in. Our whole force in the Mediterranean was ten sail of the line, each ship having 100 men short. At Salamis Bay there were ten French sail of the line, each having 100 men more than we had, and orders were sent to the French Admiral, if he thought he could insure success, to start and capture the English fleet, and when he had done so, to send word to his Government, and they would immediately declare war against England. We want the country to realize that the Navy is the right arm, the left arm, and heart of the country; its very existence depends on it, and when the Navy Estimates are brought forward, a greater number of members should take an interest in them. I have seen as few as twenty in the House whilst millions have been voted, and at other times a long discussion because the party in power had failed to build the number of tons they promised a year before. For instance, when I was at Devonport

<sup>1</sup> "His Majesty has commanded us to state that in consequence of the decree by which France declared the whole of His Majesty's dominions in a state of blockade, "and subjected to seizure and confiscation the produce and manufacture of this kingdom, His Majesty resorted in the first instance to a measure of mitigated retaliation, and that this measure having proved ineffectual for its object, His Majesty has found it necessary to adopt others of greater rigour, which he commands us to state to you you will require the aid of Parliament to complete and "give operation to."

Now for the result.

"July 4th, 1808. Parliament prorogued.

"The sanction which you have given to those measures of defensive retaliation to which the violent attacks of the enemy upon the commerce and resources of this kingdom compelled His Majesty to resort to, has been highly satisfactory to His Majesty."



Dockyard, we commenced building, but the flying squadron came home with three frigates to be refitted; the new work had to be set aside. Mr. Currie mentioned that the conditions required by the Admiralty for adapting some of his steamships for war purposes had been complied with. Owners who, when building ships, adapt them for future war service, should have an annual grant for such vessels. When the Treaty of Paris was being considered, I read that those able diplomatists separated for a day because they could not agree as to the value of a word. But they signed away the birthright of this country, the power of letters of marque, when with our Brasseys, Curries, and others, the sea should be covered with such cruisers.

Admiral Sir SPENCER ROBINSON: My Lords and Gentlemen, I wish to bring back the discussion to the important subject to which it belongs. There is no question that everyone here must feel extremely indebted to Mr. Donald Currie for the very able and elaborate exposition he has made, not only of a subject which relates to the actual state of the Navy as to its adequacy or otherwise, but also as to the best method of supplementing any deficiencies that may be found, should we unfortunately be mixed up in hostilities. In the main, with almost everything that Mr. Currie said, I concur; but we must all admit that the subjects he has treated are so diverse and so numerous, it would take so long to enter into the very many details over which such a subject has necessarily ranged, that only a very general concurrence, if there be concurrence, or criticism, if there be criticism, can be given to what he has so ably brought before us. The fact of the insufficiency of the armed Navy of this country to defend merchant ships all over the high seas, and on their arrival at the ports of this country, must, I think, be evident to every thoughtful man. It is not pretended that we have a sufficient number of armed cruisers to defend a flag which is at this very moment floating in almost every latitude and longitude that can be named, and it would take an expenditure which is really a matter of serious moment to produce anything like an armed force that can defend such a mercantile marine as we possess on those seas. Mr. Donald Currie three years ago brought forward in this very theatre very many of the opinions that he has now advocated and illustrated with great facility of expression, and with so much thoughtfulness and minuteness of detail. I myself should most strongly urge upon everybody who has any power whatever of influencing the destinies of this country, whether by speech or by writing, whether in the House of Commons or out of the House of Commons, to look seriously upon the point put before us to-day, namely, that the mercantile navy of this country can render an important assistance to the Imperial Navy of this country, and that that assistance is needed in every possible way. The points that he has brought forward are deserving of our most serious discussion. The question of arming the merchant ships is not to my mind quite an easy one, nor can it be so readily dealt with, I think, as Mr. Currie appears to suppose. We want to hear more about the weights that are proposed to be put into a ship, about the displacement that would follow on putting those weights in. When we have armed the merchant ship as he proposes to arm it, we should require to know what sacrifice of other weights, cargo, coal, stores, provisions, that a merchant ship must needs carry, would have to be made in order to allow of such a ship carrying ten 64-pounders with 100 rounds of ammunition for each gun.<sup>1</sup> If the ship is to carry that weight of armament, there must be a great sacrifice of something that the ship now carries, and her distinctive feature of a trading ship is compromised. I think myself that every merchant ship that can be made able to defend herself should be induced to do so, and the way in which, in my opinion, a merchant ship can more thoroughly be defended than in any other, is by the use of the Whitehead torpedo. A small number of Whitehead torpedoes in such a ship as Mr. Currie has referred to, in my opinion, would be a far more efficient defence against the attack of an armed merchant ship, carrying much coal, and with great speed, that had been bought for the purpose of the destruction of our commerce, than the number of guns that Mr. Donald Currie has proposed. But, after all, that is only a detail. The principle on which we are both agreed, the

<sup>1</sup> Mr. Currie explained that I had misunderstood his proposal, and that the ships, while engaged in commercial pursuits, were not to carry the proposed armament, but only to be prepared for it.

principle which I, in my small way, have advocated in every possible manner is, that as an assistance and supplementary action to the Royal Navy, we should enable the merchant shipping to defend itself. The Whitehead torpedo may not be a better thing than ten 64-pounders; but it is a subject worth discussing, and these are the details which it is impossible, within the limits of time allowed us, to discuss with any efficiency. I am not so fully persuaded as Mr. Donald Currie seems to be that the armed merchant ship is good for attack. I do not think the attack of any of these merchant steamers against a regular man-of-war, however small, would be likely to be successful. The arrangements of a ship of war are so thoroughly moulded upon ideas of fighting, that you would really have to place in each of these merchant vessels, if you got them for an attack, a man-of-war's crew, a man-of-war's practice and experience, and the whole objects for which a merchant vessel exists would pass away. But still that does not in any way lessen the force of what Mr. Donald Currie has said; that all these fast and large merchant ships should be prepared to defend themselves. I may say one or two words on that head, because my attention has lately been considerably called to it. We have, in comparison with those who might be hostile to us at any moment, not a sufficient number of swift armed cruisers to give the protection which defenceless merchant shipping requires. We have a large number of cruisers that are slow vessels, whose speed is limited between 9 or 10 knots and 13, and we might find ourselves in opposition to people who had built ships to go 16.9 knots per hour, and have smaller vessels and lighter vessels whose speed is 16 knots, and who descending from class to class, end with a small vessel of 15½ knots. Unfortunately in this country we jump from very few vessels whose speed varies from 15 to 16½ knots down to a large number whose speed is but 13, and a great part of our cruisers are vessels of even less speed. I think that a merchant vessel exposed to the attack of a swift man-of-war, however small, that could go these 15 or 15.5 knots for a very limited period, would be very badly defended indeed if she were only to trust to the guns she could carry, or to the armament, however heavy, of a cruiser that could only go 13 knots. The argument, moreover, that in the construction of ships for the defence of our commerce great speed is absolutely necessary will find itself proved and brought out by the effort which has been made by other nations to attain vessels possessing such powers, combined with an armament which would defeat, in my opinion, anything that an armed merchantman could do. It would take up too much of your time if I were to deal with the rest of the subjects brought forward, and I will not say anything further, except this. It is impossible to conceive how the minds of the statesmen of this country, however great may be their willingness to preserve peace, and however strongly they may hold that every war is an iniquity and an injustice, can escape from the certain conviction that we may have war forced upon us whether we will or no; and that if war is forced upon us, the efficiency of our Navy either to defend these islands or to protect our commerce, depends upon the supplies of coal in different regions of the world; how they can have allowed, in spite of all that has been said here and elsewhere, and all that has been written and spoken from time to time, coal depôts not to exist where they are wanted, and such coal depôts as we have to remain unfortified, is to me one of those mysteries that no one can understand. I would urge upon everyone to forward in every way he possibly can the views that Mr. Donald Currie has laid before us on the subject of the merchant navy assisting to defend itself; for I know, and I believe no one can doubt it, that the inability of the British Navy to protect our mercantile fleet is a matter of notoriety to foreign Powers and of apprehension to ourselves.

Capt. J. C. R. COLOMB, R.M.A.: I think anyone who knows anything of this subject must feel that the general question raised by Mr. Currie is about the most important and most serious that Englishmen can discuss. The most remarkable feature of our history with regard to this matter is this,—that while our commerce has been growing and developing by "leaps and bounds," our naval policy has been shrinking by "fits and starts." First of all, I will take the general policy. Our naval policy has been a retrograde policy in two respects: first, a cutting down of the brain power of the Admiralty as mentioned by my brother in this theatre last year. Anyone can satisfy himself of that by comparing the Admiralty List of past years with the present Admiralty List. Public opinion, in ignorance of the duties of the Admiralt y

has so insisted upon cutting down the administrative expenses of the Admiralty, that the arrangements for the defence of our great sea Empire now rests on the shoulders of three naval Officers, who, from the ordinary routine of the business of the office, have positively no time to devote themselves to the thorough consideration of these great questions. Another instance I will give you of the retrograde policy of this country is this: For 230 years the Royal Navy of England had a great mercantile auxiliary. The original possession of the island, so important as a military position to the safety of Mr. Currie's fleet—St. Helena—is due, not to the action of the Royal Navy, but to the East Indiamen. From 1600 to 1830 every one of those vessels was really a man-of-war. Their crews were trained, and their discipline based exactly upon the lines of a man-of-war. It was the auxiliary fleet of England; but in 1833 that whole fleet was put up at auction, and knocked down by the hammer of the auctioneer, and the Navy of England was left without that auxiliary; but it had another. The Bombay Marine then existed, and no sooner had the East Indian fleet been abolished than we created on a larger principle the Indian Navy. That had its time. It grew and flourished until 1863, and then was abolished, and the Navy of England was from that date left alone without any auxiliary power whatever. Between 1830 and 1863, the local naval resources the British Empire had created in Bombay dockyards turned out about 30,000 tons of men-of-war; some of them 80-gun vessels; several 18-gun frigates. We have wiped these resources all out now, and you are trusting the maintenance of your naval power all over the globe to the few dockyards that we have in the United Kingdom. I agree with what Sir Spencer Robinson has said, that really we cannot be too earnest about this. The country will have a great opportunity to-morrow of really learning something that it is well it should learn from Mr. Currie's paper. Mark this fact, showing you how retrograde our policy has been from a national ignorance of our real wants. In 1833, when an auctioneer's hammer disposed of this great auxiliary of nearly fifty ships—I do not dispute that the natural course of events necessitated it—we substituted nothing in its place. Our Navy Estimates were then nearly 5,000,000*l.*, and our total export and import trade was, in annual value, 85,000,000*l.*—less than the export and import trade of Australia at the present moment—what is the case at present? Your Navy Estimates are just over 10,000,000*l.* without any auxiliaries, and your export and import trade is 600,000,000*l.* per annum. With regard to the great question of arming the mercantile marine, there is one very important matter to be remembered, and it is this: the shipping of your mercantile fleet will be bid high for by neutrals on the declaration of war. All history shows this. The American statesmen of to-day tell us so,—that it will be the interest, and must be the interest, of a neutral Power to bid enormously high for our ships on the outbreak of war in order to take our carrying power away from us. That, therefore, has to be considered, as influencing the policy of trusting too much to your mercantile marine which, at the moment you most want it, may disappear behind the neutral flag. With regard to seamen the same argument applies. It must be remembered that a seaman's occupation is a marketable trade, and that they will also be bid high for; and we know, as a matter of history, that Pitt found the great national difficulty in the time of the greatest national trouble was the rapid and wholesale transfer of our shipping to neutral flags. That shows the value of Mr. Currie's enforcing upon the attention of the country the necessity of making arrangements in time, knowing that these difficulties await us. Knowing that these will occur when war breaks out, we must prepare to meet them. With regard to coal, I am very glad to see Mr. Currie has not fallen into an error, which some eminent authorities have recently done, in stating that coal is contraband of war. The coal dépôt defence question is now in the hands of a Royal Commission, and we must leave it there. The same is the case with reference to docks, and therefore I will not say anything more on that point. Having protected your coal dépôts, there is another matter to be considered. You have secured the protection of your own supply, but have you made any arrangements to prevent supplying your enemies with British coal? I think I will show you that you have not. I will take one ocean alone, and I will take that ocean with which Mr. Currie has most to do, so that if I fall into an error he will be able to correct me; I mean the South Atlantic, which, as you know, is bounded on the west by South America, on the east by the coast of Africa, and on the south by the

Antarctic Ocean. Take the case of war in that ocean, and let me tell you the defence of that which appears to some a remote part of the world is a very serious question for every one of us at home. Referring to a paper which I prepared for this Institution twelve years ago, I find the actual money value of the imports and exports coming from that ocean, or going there, is 27,000,000*l*. The traffic round the Cape I estimated at 91,000,000*l*., and the traffic round Cape Horn at 40,000,000*l*., making a total of about 150,000,000*l*. Lord Carnarvon has since stated that only 60,000,000*l*. goes round the Cape, and therefore the total value of that ocean to Great Britain at this moment may, at any rate, be fairly put down at 120,000,000*l*.<sup>1</sup> That is a money area which the British people will understand, and should take measures for protecting. But now listen to this: There is about 6,000,000*l*. of gold continually coming across, and about one-seventh of the total wheat supply for the population of these islands also crosses that ocean. About 7,000,000 quarters of wheat came last year. Then as to coal. I find more than a million tons of English coal crossed that ocean last year, and of that quantity under 150,000 tons only were going to places in British Possessions. The Royal Commission will, I have the fullest confidence, adequately provide for the defence of your coaling stations, but it must leave in that ocean 850,000 tons of British coal really unprotected and available in neutral ports for the enemy. I find on the western shores of that quarter of the globe they take on an average nearly 400,000 tons. What does that state of things involve? Your preparations in war will involve guarding the neutral points where that coal goes to, and how is that to be done? By a fleet of observation off South American ports, and that will immediately cause an increased demand for your fleet. If you have a war, what are the demands on your Navy and on your mercantile marine? The first thing is to blockade all the enemy's ports. Has anybody any idea at all what force would be absorbed of the Royal Navy in blockading a possible enemy's ports? At the time of the American War, Mr. Wells called in eminent shipowners to give advice as to what they were to do with regard to naval affairs. They bought twenty sailing vessels, and they gave it as their opinion that if they bought thirty more sailing vessels they could seal up the ports of the South. That was the idea the best authorities of the American nation had of the requirements of a blockade, but experience showed how far they were from being right. It took 600 vessels, most of them steamers, and then they did not succeed in blockading the enemy's ports. Take any coast you like, and see, after providing for blockade, what margin you will have left for the defence of your own commerce; you will have very little. Of the force you will have left you must place a squadron at the Equator, and between the Equator and the defended station of the Falkland Islands on the one hand and the Cape on the other, you will have your commerce passing still quite unprotected unless you follow the advice of Mr. Currie and look to this matter in time. There is one other point to which I must draw attention, and that is with regard to the men. I have given you some idea of the demand you would have for ships, and therefore how necessary it is to prepare for it. Now let me briefly draw attention to a rule of thumb calculation with regard to trained men. The constant trade as represented in shipping tons of British steam-ships to and from ports in the South Atlantic amounts to over 200,000 tons. Suppose that one-half of that tonnage is available for carrying guns; a fair estimate may be struck by allowing one gun for every 300 tons; 100,000 tons will give you, therefore, 300 guns, and allowing ten men per gun for fighting duty, &c., if you arm but one-half the steam tonnage regularly plying to that quarter of the globe, you must therefore be prepared to give these steam lines at once a force equal to 3,000 trained men. That is only one quarter of the globe, the other three would take 9,000 more. I could go round the globe and show you in this rough way our necessities on every ocean. I ask you to remember what Mr. Donald Currie says in conjunction with this fact of the paucity of England's naval power as regards trained men. I cannot sit down without

<sup>1</sup> Since the opening of the Suez Canal, it is not possible to calculate with exactness the value of commerce passing round the Cape. Some ten years elapsed between Lord Carnarvon's estimate and mine, and in the interval the increase of commerce adopting the Canal route in preference to the Cape has been great; this in some measure accounts for the discrepancy.

expressing my own personal feelings with regard to the way in which Mr. Donald Currie has brought this question forward. I think it was Swift who said that the man who made two ears of corn to grow where only one grew before deserved better of his country than the whole race of politicians and patriots put together. When Swift uttered those words we grew our own food, and could take it from the fields to the mouths of the population; but if Swift lived now he could hardly draw the same comparison. We are now dependent even for our very food upon the traffic of the sea, and I would say, if I may be allowed to paraphrase so great a man's words, that the Englishman—in the state of affairs I picture, of a huge population dependent upon the safety of the sea and the traffic of the sea for its food—who makes two steamers to ply where only one plied before certainly deserves well of his country. This paper has a treble value; it has its intrinsic merit and its inherent worth, and the more one knows of the subject the more one sees its breadth and depth. I think it exceedingly fortunate that at this moment, concurrently with Mr. Currie's paper, we have Sir Spencer Robinson's article in the *Nineteenth Century*, and the thinking portion of the British people taking these two papers in conjunction and calmly weighing them, will have serious ground for apprehension as to what might happen if we become suddenly involved in war. Mr. Currie's paper is not only valuable for its intrinsic worth, but it is valuable in that it comes from the source it does, from the mind of a practical shipowner, and it is valuable also because, coming from a civilian so well known, it is quite certain to command the attention of the public, by the force of whose opinion we are governed.

Captain BEDFORD PIM, R.N., M.P.: I think we shall all agree that Mr. Donald Currie's paper is one of such vast importance that it would be very wrong not to adjourn this discussion. I know of several gentlemen who would be glad to speak upon the matter, and therefore I beg to move that this discussion be adjourned.

Mr. CURRIE: I should be glad to say one word with reference to what has fallen from Sir Spencer Robinson, as it was not my intention, nor was it stated in my paper, that the merchant ships intended for cruisers should carry their armament in time of peace. What I meant was, that arrangements should be made in time by the Government, and that the armaments should be in readiness for all engaged steamers, both at the Colonial stations and in the Home dockyards.

The motion having been seconded, the meeting was adjourned to Thursday, the 11th of March.

---

[ Thursday, March 11, 1880.

#### THE MARQUIS OF LANSDOWNE in the Chair.

---

The CHAIRMAN: Ladies and Gentlemen, I have to invite you to a renewal of the discussion which began last week, on the subject of Mr. Donald Currie's paper. The adjournment was moved by Captain Bedford Pim, but before he proceeds to offer his remarks I believe Sir Spencer Robinson wishes to say a word on a matter of personal explanation only.

Admiral Sir SPENCER ROBINSON, K.C.B.: Before the proceedings commence, I wish to say just two words of personal explanation. Entirely through a mistake of mine I misrepresented something that Mr. Donald Currie had said at our last meeting. I beg leave to say that the fault was entirely my own, and did not lie the least in the world with the very lucid exposition which Mr. Donald Currie had given us.

Captain BEDFORD PIM, R.N., M.P.: With regard to my friend, if he will allow me to call him so, Mr. Donald Currie, I am sure no one in this meeting can entertain a higher respect for his enterprise and energy than I do, or a higher sense of the importance of the paper he has brought before us. It was my duty on Monday night in the House of Commons to draw attention especially to the true state of the

mercantile marine of this country, and to show that Mr. Currie's conclusions with regard to utilizing merchant ships in the event of war, except for the purpose of transport, or for laying out coals and bringing home our food supply, or for carrying mails, was in my humble judgment perfectly fallacious. One glance only at the plans and sections on the walls must convince any sailor that it is utterly impossible for a merchant ship ten times her beam for length, flying light, even to bear the top hamper of guns on her upper deck. If you were to attempt to run out a gun on the upper deck of a ship such as the "Hecla," and the other skilly-galee above it, flying light, only *one* of the guns proposed by Mr. Currie, in my humble judgment the vessel would capsize immediately. In bringing forward the subject on Monday night, I mentioned that before adopting Mr. Currie's proposal it would be the duty of the First Lord of the Admiralty to take one of these merchant steamers, flying light, into dock, and run out one gun to make the experiment, or the nation would "buy a pig in a poke." It seems ridiculous to think of carrying guns with such a midship section as is represented on the wall, but it would be the clear duty of the First Lord to *try* their stability before entering into the proposed arrangements for merchant steamers to do the work of the Navy. I have not the slightest doubt of the result; I have given great attention to the mercantile marine of the country; I served in it myself, and at the present moment I am Honorary Standing Counsel to what is left of the British seamen of this country, so that I know both ships and men pretty well, and I may be permitted, therefore, to give a slight sketch to you, my Lord, and to the meeting generally, of our mercantile marine. It consists in round numbers of some 25,000 ships, and it has a body of 200,000 or 230,000 men attached to it, of whom I am sorry to say 80 per cent. at least are foreigners. To my certain knowledge there are in the mercantile marine of Great Britain at this moment between 8,000 and 10,000 Russian Finns. Where would these men be, I ask, in the event of war with Russia? I merely mention this to show what the mercantile marine really is. We have absolutely no men to depend upon at all. I suppose there is no man in this room who has ever been to sea who does not know perfectly well that the foreigners in our merchant service, even supposing we could trust them (which is more than doubtful), would not stop for a single moment in the event of war. According to the return of Admiral Phillimore (than whom there is not a more competent Officer in Her Majesty's service), 12,000 men are all the British seamen that we have in the mercantile marine of this country, out of 230,000 men. The position of the country depending, as it does, on the mercantile marine, seems to me to be critical in the extreme, and I do not know what you are going to do to meet such an emergency as would arise in the event of war. Every seaman that you have in the Royal Naval Reserve—which I had the honour of starting twenty years ago in North Shields—is employed in the mercantile marine. You cannot take one man away from laying out your coals and bringing in your food. Everybody knows that we are no longer able to support ourselves in this country upon our own soil. We have at least two-thirds of our food brought to us from abroad. It is a serious matter, frightfully serious, you must all admit, both with regard to the men, and equally serious with regard to the ships. A good deal of this is owing to free trade. I said on Monday night, and I repeat it, I believe it has been the curse of the country. I love and respect Englishmen, and would do anything for them; but why should foreigners enjoy greater privileges in our land than ourselves? The condition, it seems to me, of the mercantile marine of this country is critical in the extreme, especially with regard to the men.

Here are a couple of models of two kinds of ship, one is nine times, only *nine* times, her beam length, and she has the same draught of water as the other, which is four times her beam length. In the case of the shorter ship, you can run out any number of guns, but I should like to know if any one would attempt to run out a gun upon the other. Most steamers are now ten times the length of their beam, and they are called magnificent steamers; but I say that you cannot run out one gun, let alone four or five, on the upper decks of vessels of that kind. It is marvellous to me that we go on building ships of this sort. These two ships are exactly the same tonnage, the cubic contents of each is 972. The length of the short vessel is 180 feet, and the beam 45; whereas the length of the other vessel is 270 feet, and the beam 30 feet. The all-round measure of one is 360 feet, and of the other 540 feet; so that there is



absolutely 30 per cent. more money required to make a long unseaworthy vessel. How shipowners can be so blind I cannot understand. The fact is these are notships at all; they are built by the mile, and British seamen call them "gas pipes;" they are neither more nor less. It seems to me that such a state of things as this ought to be looked into with the very greatest care and attention. I for one desire to render to Mr. Donald Currie my warmest thanks for having had the courage of his convictions, and for coming down amongst this body of seamen to ventilate this subject; but I join issue with him entirely, and I say that if the Admiralty take even his ships—and I am told that they are the very best of the mercantile marine of the country—they will simply be cutting their own throats, and incurring a responsibility for which they will have to pay dearly. Why should we do so? I suppose Mr. Currie will hardly deny that a ship of this sort will cost the nation—assuming the same price is paid as was paid for the "Hecla"—70,000*l*. I suppose Mr. Currie would be sorry to part with one of his ships for a less sum than that? Now, for that sum we could build, and that within a few months, at least five, if not six, gunboats, any one of which would sink any merchant ship that ever swam. I have seen the "Algerine," commanded by my dear friend, the late Captain Charles Stewart Forbes, who was known to some Officers present as a most splendid and gallant fellow. I have seen, I say, the "Algerine" under his command at the foot of the Indian Ocean sailing round a Dutch East Indiaman, with topmast studding sails set. It is not only possible but easy to build a gunboat of such a nature as even to sail, to say nothing of steam, as fast as any ship afloat; it only requires a little skill. Instead of throwing nature overboard, as is too much the fashion, and taking to a spurious sort of science which all practical men despise, the plans which our forefathers taught us should be adopted in shipbuilding, giving us sections that we know how to deal with. The class of vessels which we have now seems to me perfectly dreadful. It may be said that to place a 38½-ton gun on board a gunboat of, say, 500 tons, would be at all events a little risky. Not that sailors care a snap of the fingers about a vessel being risky; but there is an Officer in the room who has invented a process by which he can obtain as much initial velocity from a 6½-ton gun as you can get from a 38½-ton gun. The plan is before the Admiralty at this moment. I have personally nothing to do with it beyond wishing the inventor good luck, but the inventor has done me the honour of showing me his plans and his proposal, and I believe they are perfectly sound. If that is the case, and if you can reduce the weight of the guns so much as this gentleman says, you can then, of course, resort at once to very small vessels which can be built for something like 9,000*l*. or 10,000*l*, and keep the sea, under sail, in all weathers, and manned with volunteer seamen would simply enable Old England to defy the world. I desire again to thank Mr. Currie most heartily for having brought the subject before us. I hope that it will be thoroughly threshed out by practical seamen, and that the country will not be allowed to go into an expenditure which in my opinion is absolutely useless, not to say wicked.

Colonel CLINTON: After what we have heard from Captain Bedford Pim, it is hardly requisite that I should say more than a few words. With reference to the subject which has been brought so ably before the Institution by the lecturer, the principal inquiry to be made is, would not the smallest heavily armed screw steam gun-vessel, capable of carrying one heavy gun, be always able to master any and every merchant vessel, however large, which did not happen to be as heavily armoured and armed as itself? That is to say—unless while under the protection of war vessels, would any merchant vessel have a chance of being able to cope with such an apparently despicable foe, if it was not at least as heavily armoured and armed as the enemy by which it was attacked? If that be so, surely the question raised by the lecturer is at once set at rest for all time; the question, namely—whether the English nation could depend upon the mercantile navy as at all likely ever to be capable of successfully aiding us in our efforts either in the defence of their own ships or in the attack of hostile vessels? Consequently we seem to be driven to the conclusion that nothing can ever be satisfactorily effected towards securing and maintaining the peace of the seas, unless some arrangement could be entered into for that express purpose. Now, this is the age of great companies and of amalgamations with great companies. The Indian Government has been amalgamated with the Home



Government. Why should not the Mercantile Marine Service become national like the Royal Naval Service?

Colonel HOPE, U.C.: I desire to say a few words in consequence of the allusion made by Mr. Currie to the guns proposed to be placed on his ships, to which he applied the epithet "powerful." He mentioned that they were only 64-pounders, but he did not say which class of 64-pounders he contemplated. There are no fewer than seven different patterns of 64-pounder rifle-guns in the service now, varying from 58 cwt. to 5 tons; but even the best and the heaviest of these are not classified in the Ordnance sheet as "armour-piercing" guns at all, and consequently Mr. Currie's ships could not defend themselves against the smallest gunboat with a heavy gun which had any protection whatever. As Captain Bedford Pim mentioned, I have recently submitted to the War Office and the Admiralty an offer to construct guns for the use of the Navy of three kinds. The smallest is  $6\frac{1}{2}$  tons, guaranteed to beat the 38-ton gun in every particular, effecting a saving of 80 per cent. in weight, 60 per cent. in money, and from 90 to 95 per cent. in time of construction, or not to be paid for. The second is a 16-ton gun, guaranteed to beat the 80-ton gun in every particular, or not to be paid for. The third is a 28 $\frac{1}{2}$ -ton, guaranteed to equal an Armstrong 150-ton gun, or not to be paid for. That offer does not repose on my own calculations only, but on those of the only man alive who has ever sunk an ironclad ship with guns of his own manufacture—I allude to the well-known defender of Charleston, General Ripley. General Ripley was educated at the United States Military Academy at West Point, qualified for the Engineers, but chose the Artillery; was for a short time Assistant-Professor of Mathematics at West Point, was on the Staff of the American Army throughout the war in Mexico, and retired from the United States service in 1853 with the rank of Major. By command of the Governor of his State (South Carolina) General Ripley fired the first shot of the American Civil War, and took Fort Sumter. He afterwards defended Charleston for several years, during 585 days of which he was actually bombarded. By the aid chiefly of rifled guns of his own manufacture, improvised in a railway workshop, he repulsed the combined attacks of the Federal land and sea forces, and in particular that made on the 7th of April, 1863, by Admiral Dupont's ironclad fleet, consisting of the "Ironsides" frigate, the double-turreted monitor "Keokuk," and seven single-turreted monitors. The "Ironsides" was protected by  $4\frac{1}{2}$  inches of solid iron, and the "Keokuk" and the other seven monitors by 10 inches of iron built up. This attack he repulsed in two hours and twenty-five minutes, at ranges varying from 900 to 2,000 yards. As the result he sunk the "Keokuk," and put five of the other seven monitors, together with the flagship "Ironsides," *hors de combat*. I think that an offer from such a man as that, and from another who has, at all events, had the advantage of looking at a gun from both ends, is not unworthy of some consideration. If Mr. Currie will give me the weights of the guns which he has calculated for, I shall be happy to give him a calculation of the effect of guns of that weight made on my principle. I feel little doubt that I could give him an armour-piercing gun which would be able to pierce armour at a range exceeding the ultimate range of the 64-pounder he alludes to.

Admiral HOSKINS, C.B.: I had not the opportunity of hearing the lecture which Mr. Currie delivered the other day for the benefit of this Institution, but I have read it very carefully; and from the point of view in which I have had the advantage of studying the subject in Australia, I may perhaps be permitted to say a few words with respect to the employment of these large ocean steamers as men-of-war. When I was in Australia the question was constantly asked me by merchant ship-owners and freighters, first, "In the case of war being declared with Russia, what are you going to do for us?" and secondly, "What are the Government at home going to do?" To the second question I could only reply that I had not the slightest idea; but as to the first, after a great deal of thought, I was able to come to some clear understanding; and that was, that in case of war being declared, and it being known that the enemy's cruisers were likely to molest the commerce, it would be absolutely necessary to lay up all sailing ships in the first place. That was the only rational thing to do, speaking from an Australian point of view, and to employ these large ocean steamers, which are growing in number daily, and are monopo-

lizing two-thirds of the traffic in the Atlantic. Of course trade would be very much restricted, and other inconveniences would follow, but the least loss would be likely to result from it. That view was warmly taken up, and I have been thanked for it on several public occasions. Then the question was asked, "Don't you intend to do anything to protect the steamers?" and I always answered, "I do not see any necessity for it except at the coaling stations, the touching points, and their immediate proximity. I believe that no vessel that any probable enemy of England could put to sea would be able to run those vessels down; and if they did, if they were lightly armed to protect themselves (a suggestion of which Sir Spencer Robinson approved last week) they would probably be able to keep off any of the vessels that the Russians were lately talking of preparing against us. I think the whole question almost resolves itself into a question of coaling depôts and docks, and protection for them. The depôts being fixed upon and fortified, our squadrons would be best employed in their neighbourhood, ready to protect them, and to see that the lines converging upon them, where the ships would be most likely to be intercepted, were kept clear."

Lieutenant CHARLES CAMPBELL, R.N.: In the paper that was read on Friday a great deal was said about coal depôts, but no mention was made of possible floating coal depôts. I should like to ask Mr. Currie if it would not be possible to utilize such ships as the "Great Eastern," or large vessels of very great carrying power for coaling the fleet, to attend upon them or meet them in certain latitudes, and would not the humbler class of merchantmen find ample work in carrying coal to the ships direct,<sup>1</sup> as was the case in the late operations in the Mediterranean, where they coaled the fleet alongside? Such vessels would run very little risk of capture. They have a speed of about 10 knots, and their contract might run that if the enemy should overtake them they should take to the boats and scuttle the ship, so that the enemy might not get the coal. With regard to the question of employing naval Officers in the merchant service the idea sounds very well, and we know that in the *Messageries Maritimes* the French employ Officers aboard their ships. It is all very well in peace time, when an Officer can say that he will be on half-pay long enough to make it worth while for merchant owners to employ him; but in such a war as was foreshadowed the other day we should require every Officer in the Government list, ay, and many that have retired as well, to man our own ships and conduct our own operations; and, as the Irishman said, "a man is not a bird, he cannot be in two places at once." With regard to the armament of ships, I agree with Mr. Currie. There is not one in a hundred of our merchant marine that comes up to the standard; but I think there are many vessels with a speed of 10 knots capable of carrying four guns of small calibre, say the 13-pounder gun lately tried at Shoeburyness, which sent an ogival-headed chilled projectile through a 5-inch armour-plate, and they might also carry the Nordenfolt and the Hotchkiss guns all round the deck. Mention was made of taking up transports abroad. We could not have a better opportunity of judging of the capacity of merchant vessels so employed than we had when the Indian troops were carried to Port Saïd and Malta and taken back to India. I was present with the Admiral at Port Saïd when he inspected those ships, and I venture to say finer vessels for the purpose could not be found under the flag of any other nation. With regard to the necessity of a scheme, I fully agree with every word that was said on Friday as to the importance of this question, and our best thanks are due to Mr. Currie for having brought it before us. But if we have a scheme it must be a practical one and be carried out at a minimum cost. We must remember that our Naval Estimates are 10,000,000*l.* already. With regard to the position of England, I believe that in the event of such a war as was foreshadowed on Friday we are as fully prepared as any nation can be in peace time for a great and lasting struggle. This is not a party policy; it was the policy of Rome, and it is the policy of Great Britain. Gibbon tells us that the terror of the Roman arms added weight and dignity to the moderation of the Emperors: they preserved peace by constantly preparing for war. They announced to the nations on the confines,

<sup>1</sup> Not necessarily for coaling at sea, but to give the Admiral the power of sending them in, under the lee of the land, or into the nearest available port, with a portion of the squadron to fill up.

that they were as little disposed to endure, as to offer an injury. Lord Palmerston told us at the close of a debate in the House of Commons, after the Indian Mutiny, that peace, however long it might continue, would not depend merely upon ourselves, but upon the conduct of other Powers, and you must be prepared by having a force sufficient at least to protect you in the outset from insult and attack. Depend upon it, for a country great and rich to leave itself without the means of defence, is not a method to preserve peace in the long run. It was said the other day that it would take three months for our mercantile marine to be ready to co-operate with the Royal Navy. I should like to know how long it would take any other nation to arrive at the stage we were in at the time when war was declared. It is also stated that foreign Governments are watching us with the greatest scrutiny and observing our minutest details; and I read the other day that the only people ignorant of our weakness are the Government, Parliament, and the British public. All I can say is that if we are in that awful position we had better wish with my countryman, Robert Burns,

"Oh! wad some power the giftie gie us

"To see ourself as ithers see us."

Captain LONG, R.N.: This is a question on which, as it goes to the heart of the nation, I think we must endeavour to get some light; and it is more especially interesting to naval Officers, being part of the science of naval strategy, if, indeed, we can call that a science which has neither professors nor text books. It is stated at page 24 of Mr. Donald Currie's paper, that nothing has been really done. Now, I happen to know, as an outsider, that a great deal has been really done; and I cannot refuse my humble tribute of admiration to a department of the public service which has, in a time of unexampled progress in the application of science to war, managed to gather the first fruits of every invention for the Navy and for the nation. The next point to which I wish to refer is that of our coal supply and our docks. There I go heartily with Mr. Currie. Our coal supply, as Captain Colomb has pointed out, is the very life-blood of a man-of-war in these days. Nelson, when he was in chase of the French fleet before the battle of the Nile, said: "If I were to 'die now, the 'want of frigates' would be written on my heart." I hope that no British admiral will ever have to say that the "want of coal" was written on his heart. There are two words at page 16 which seem to contain the whole gist of the matter—"Admiralty requirements." What are Admiralty requirements? The protection of the trade of this country. What is the trade of this country? 20,400 sailing vessels and 4,800 steamers. Now, of those steamers, 148 range from 2,900 to 5,250 tons gross register. What is the speed at which that trade is carried? I think we may divide our steamers into three classes, and perhaps there is a fourth, as the ruck. The first class, such as the "Germanic," the "Gallia," and the "Orient," have an average speed of 14 knots on voyages, and on favourable occasions as high a speed as 17 knots. The second class of vessels, such as those composing the Royal Mail Packet Company's service, the Peninsular and Oriental Company, and the like, average from 11 to 12 knots on a through voyage. The third class average about 10 knots, certainly not more than 11. Then as to the distance that these vessels have to go without coaling. Captain Colomb tells us, after the most complete investigation, that 3,500 miles is the distance which a ship must be prepared to go without coaling. I have no hesitation in saying that a ship ought to be able to go that distance at a speed of 10 knots. Now, how are we to protect this great commerce? Here we must fall back upon the lessons of history. By blockade and convoy. Now suppose we have to convoy a number of vessels, how are we to do it? It might be necessary to convoy the slower ones. Now, in my professional experience there are two things which I have witnessed bearing upon this question. The first was the passage across the Black Sea in the year 1854 of a flotilla in company with the allied fleet. That was a short distance. I do not know the exact number of the vessels, but I know that the Cossack who reported their advent in Sebastopol said that there were so many he could not count them. The second is the cruise of the first flying squadron under Admiral Hornby, and on two occasions that squadron traversed 3,000 miles under sail (six ships in company) at an average speed of 9 knots. I think those two facts go to prove that there would be no difficulty what-

ever in conveying the food and provisions required for this country at a speed of 11 knots across the ocean. The next question is, what number of vessels would be required for such a purpose. This is a matter which of course it is impossible to arrive at an accurate conclusion upon, but I find that if we go back to the year 1797, when cash payments were suspended, and the funds were at 51, and the fleet was in mutiny, the Naval Estimates were 13,000,000*l.* odd. There were then 108 sail of the line in commission, and 153 cruizers commanded by Post Captains. Now what was the trade which we then had to protect? I find that there were (with the nearest approach to accuracy that I can get) 1,100,000 tons of shipping cleared outwards from this country in the year 1797. In 1878 there were upwards of 50,000,000 tons of shipping cleared from this country. Then comes the question, have we vessels enough in the Navy which are competent to protect this trade? I need hardly go into that question, for the highest authority, the First Lord of the Admiralty, says that we have not got vessels enough under some contingencies. As far as I am aware, we have nine vessels capable of convoying what I have described as the second class, and two vessels which may convoy those of the first class, and perhaps thirty, which, if they had coal enough (which I doubt), might be capable of convoying the third class. Then we come to the capacity of our merchant shipping for self-protection. I will not go into details as to naval architecture. This country possesses some of the first naval architects in the world. But I think it is quite clear that the Navy at present is insufficient to protect all this great trade; and as I do not think anybody can see a reasonable prospect of our having a Navy large enough for the purpose, it behoves us to turn our eyes seriously to this question, and to see that these subsidies which we give for mail service are not given without due regard being paid to the subject. With regard to the capacity of these ships to defend themselves, there is no doubt that such a merchant ship as the "Germanic," if she can carry guns enough in the way described, would be a formidable antagonist. If three of these vessels were to sail together from Liverpool, I should like to see the Russian cruiser that would touch them. They would have to attack them with more than one. Three such vessels in company having good rams, and having their engines protected and a few guns, would be very formidable in the hands of our splendid merchant seamen. I agree with Mr. Currie that such vessels would be quite as valuable for war purposes as a vessel like the "Shah." One other question remains to be noticed. We cannot, I think, help noting the coincidence that a distinguished Naval Officer and a shipowner eminent for his patriotism, should have come before the country at this juncture to point out the insufficiency of our forces. This indicates a want of confidence where it should most surely be found. How is that want of confidence to be avoided for the future? We have at the present moment a Royal Commission sitting to consider the question of our colonial defences. Now I venture to think that there should be a strengthening of the professional element on the Board of Admiralty by the association of a Strategical Council, composed of ex-Commanders-in-Chief of foreign stations, a Royal Engineer of eminence, and perhaps an Officer of the Marine Department of the Board of Trade. And if this Council were to present a report annually to the First Lord before the framing of the Estimates, as to the bearings on strategy and tactics of the latest application of science to war, the country would then know that the best informed and most practical minds were directing their attention to those important subjects, free from the trammels of administrative business.

LORD ALFRED CHURCHILL: I feel great diffidence in speaking upon this question before such an audience, and I do not know that I should have attempted it had it not been my fortune very recently to have inspected the ideal ship that has been referred to. A Committee of the Society of Arts asked Mr. Donald Currie to allow them to inspect his latest ship, which he did. We saw it under the most favourable circumstances, and I may mention that I was accompanied by Admiral Nolloth and Captain Toynbee. The ship was entirely empty, and we went over her right down to her keelson, and into every compartment. There is an illustration on the wall of the various compartments into which the vessel is divided. It will be observed that there are certain horizontal and perpendicular compartments. Each of those represents an entire space. If it were filled with water, the water could not get into another. There are twenty-two of those compartments in all. Not only are

the upright ones of iron, but also the longitudinal ones; and the decks themselves, although covered with wood, are of iron, therefore if the water went into one compartment, it is impossible that it should get into another. That has been practically tested. On a recent occasion one of these ships, the "Windsor Castle," caught fire in one of the compartments, and it was extinguished without communicating with any other. The same ship subsequently came to grief near the Cape of Good Hope, and running ashore she held together by her immense strength for two or three days while the cargo and passengers were saved, although the vessel was eventually lost. I merely mention that to show the strength with which the vessel was constructed. In addition to that she has three or four compartments between her keelson and false deck, capable of holding water and ballast, or of being pumped out and filled with air. I think this appears to be, as far as we can see at present, the most perfect type of cruiser that we can imagine. I may also mention that she can steam from England to the Cape of Good Hope and back again without recoaling, at the rate of 12 knots an hour. I think that at any rate will satisfy the last speaker as to the capability of the vessel in keeping at sea. I asked Mr. Currie—"Supposing she was not laden with cargo and sailing for a long cruise, how long she could keep at sea?" and I believe his answer was (he will correct me if I am wrong) "at least fifty days, steaming at 12 knots an hour." But since then, I am told she could, if used solely as a cruiser, carry 3,500 tons of coal, which at a consumption of 40 tons per day, would give eighty-seven days' steaming. The question of armed merchant ships divides itself into two classes. There is the cruiser which is capable of acting efficiently for offensive purposes as a man-of-war taken up by the Government, and there is the cruiser which, being armed, carries on her legitimate commerce. I wish there were more of these vessels than we have at present adapted for these purposes. With regard to their guns, my impression is that ten are too many, and two swivel guns perhaps will be more efficient, but that is a minor point. It may be necessary to remove a few deck houses, but that also is a matter of detail. The question is whether such a vessel is capable of acting efficiently as a cruiser; and I believe she is. I think we are all deeply indebted to Mr. Currie for having raised this question. There are few shipowners who have exhibited so much patriotism as he has. He has the heart and soul of a patriot, and he has the means of putting his ideas into execution, and illustrating what can be done in this direction. Sir William Hall, who spoke at the opening of the debate, was reminding us of the wonderful heroism and deeds of glory which were performed by our Navy in former years; and these deeds, he said, were done when the population of the country was only 13,000,000. Well, no doubt, those were glorious deeds, but we have progressed since then; and I may remind our friends, Admiral Hall and Captain Pim (who objects to free trade), that our population has doubled since those days, and we are now under very different circumstances. The country no longer gives us all the food that is necessary, and we must therefore seek it abroad. Our very existence as a nation depends upon our being able to get not only ample supplies of food, but also that raw produce from which we manufacture those articles, which are necessary to the civilization of mankind. Sir Spencer Robinson, in an able article in the *Nineteenth Century*, informs us that our Navy, powerful as it is, is not sufficient, in his opinion, to resist a combined attack. It may be sufficient to defeat any one or two Powers, but if we have a combination of all the Powers against us, he does not think that we are sufficiently strong. Now, what is the best mode of meeting that? I think the best mode and the cheapest in the end is to adopt the principle laid down by Mr. Donald Currie, and by Mr. Burns, who has written an able letter on the subject in the *Times* of this morning, to arm our merchant ships, and to enable them to adapt themselves as cruisers, in the event of war. Those cruisers might either be taken up for offensive purposes by the Government, or they might carry on legitimate commerce as armed cruisers. I do not believe that the Treaty of Paris, which we have heard so much of, would in the event of war be anything more than waste paper. I do not say that England would be the first to break it, but other nations would break it; and if we are attacked, and if our commerce is attacked by those who break the Treaty and put privateers in operation, we shall be absolutely compelled in self-defence to do the same. It is therefore most essential that we should be prepared beforehand to meet any attack from whatever sources it may come. I think that

the question which is now before us is one which, now that it has been so ably opened by Mr. Currie, will deserve the serious consideration of this country.

Commander GILMORE, R.N.: I think this subject is one of the greatest importance, not only to the Navy, but to the country generally—the question is whether we ought to keep a sufficient quantity of men-of-war to protect our commerce, or to subsidize merchant vessels for that purpose? In olden times they believed in what were called frigate-built ships—ships built by owners who, on condition of building vessels capable of carrying broadside guns, received some support from the Government. Such arrangements do not now exist. The commerce we have to protect amounts to the enormous sum of 800,000,000*l.* sterling; that being the amount of property passing to and fro in English vessels between England, the Colonies, and foreign countries. Then the question arises as to the conversion of these vessels, whether it would not be more expensive to convert them than it would be to keep a sufficient number of fast cruisers on the list of the Navy. Speaking broadly, I think that to take one of these merchant vessels and to make it a sort of man-of-war would not cost less than 20,000*l.* You would have to take away the passenger accommodation to strengthen the decks; and not only that, but to strengthen the vessel from keelson upwards. Then the question is, as Captain Pim says, are these vessels, from their extreme length, capable of carrying heavy guns on the broadside? I should say, certainly not. Then another thing is, these vessels will have to stand end-on fire. A shot from a 38-ton gun would go through both sides, and if a shell were to burst in the coal bunker it would smash everything around it. Then there is the question of coaling depôts. Ship B is, I suppose, a *rara avis* (there is none other like it in the world) steaming 12 knots for fifty days' running. Captain Colomb says that it is necessary to go 3,000 miles without coaling. Now there are very few of our men-of-war that can steam 3,000 miles. Some of our very fast vessels can only carry coal for three days, going perhaps 1,000 miles. When we gave up Vido some years ago to Greece, we in fact gave away half-a-dozen ironclads; we did away with our principal coaling station in the Mediterranean, and there are very few places in the Atlantic where you can get coal. There is Madeira, where the stay is very short, and you are obliged to be off at a moment's notice. The weather is often heavy that you cannot coal, except in very small quantities. At St. Helena the coaling is difficult, and also at Ascension. As to the "Great Eastern" carrying coals to coal the fleet at sea, any sailor might see the absurdity of it. How can you coal vessels, except by single bags, at a time when they are rolling heavily in the trough of the sea? I think that this question ought to be thoroughly threshed out. It must not be supposed that this is the only plan which can be adopted for the protection of merchant commerce, but a number of cruisers might be a part of our permanent force, forming, as I believe they would, a very valuable auxiliary to the Navy.

Commander CURTIS: I concur with all the other speakers in thanking Mr. Donald Currie for bringing this all-important question before us. It leads over a very large subject, and it suggests the question whether it is necessary for this country to have an *efficient* Imperial Naval Insurance to keep inviolate the commerce and dependencies of Great Britain. Mr. Donald Currie has told us that merchants were called upon by the Admiralty to send in a list of certain ships with a view to see whether those ships were able to meet certain ships that might be opposed to them. The shipowners asked for a subsidy, and I rather think Mr. Currie states that the merchants felt themselves somewhat aggrieved, inasmuch as they had not received compensation for any money they might have laid out. If that is the case, I for my part think it is only due to the merchants that they should be reimbursed for any extra expense that they have incurred in order to meet the views of the Government. But supposing such ships should prove not to be suitable some little time hence, and the Admiralty were to construct a class of ships suitable to protect our commerce, to be able to steam 5,000 miles at 10 knots an hour, and if necessary to put on a spurt of 13 knots, it would not do to build such ships with a length ten times their beam, for a vessel of such proportions cannot manœuvre. These ships for the time being are supposed to meet other ships, and the class of ship best suited for the purpose would be a ship having a steel movable belt which could be shipped or unshipped, also a ram that could be shipped, and fore rudder, according as the vessel



is required for commerce or for war.<sup>1</sup> By means of such armour she could be made shot proof. I would have the ships always armed with two guns and one rotary gun, so that the men could be exercised on their peace voyages. The Admiralty employing these vessels, by so doing would have efficient Officers and men when an emergency occurred. According to Whittaker, the imperial wealth of this country,<sup>2</sup> imports and exports, is 932,300,000*l.*, and the naval expenditure is 10,500,000/<sup>3</sup> what is that? A little over one per cent. on the commerce<sup>4</sup> that has to be protected in its transit across the water.

Admiral LETHBRIDGE: We have to thank Mr. Donald Currie for his very able paper, which I consider one of very great importance to this Empire. If war breaks out, no doubt the first thing will be the destruction of the Suez Canal. You might have an ironclad at either end, but gold would blow the banks in, and therefore we must not look for a passage that way. We shall then have to rely upon the passage round the Cape of Good Hope. I would ask, in the event of war, whether it would not be advisable to have a flotilla ready to go forth from the Cape to guard our commerce as it comes along. That touches upon the coal question, and it also touches upon the dock question. At Simon's Bay, which is our naval arsenal at the Cape, what have we in the shape of docks? We have nothing. We have a patent slip capable of hauling up a vessel of 1,000 tons, but nothing more. The fortifications are mostly unfinished. The fort on the north side is complete, and mounts 38-ton guns. The other on the south side is incomplete, and is intended to mount 38-ton guns. Officers who have been there fully understand the position of the Roman Rock. That is a position which could be well fortified to defend our dockyard against vessels in the bay. It could be destroyed by electricity should it fall into the enemy's hands. Just inside Noah's Ark on the mainland, a new battery is being constructed to mount 38-ton guns. Opposite the hospital there is a depth of water 18 feet at dead low-water; with a rise of 5 feet spring tides it would be very easy to construct a dock there for taking in the ships which are to guard our commerce. Ships will get foul, and require docking every four, five, or six months; therefore it is necessary to construct docks to enable them to keep the sea, for, as everyone knows, directly the bottoms of ships get foul, away goes the speed. As regards another station for coal, I should suggest Sierra Leone. At Sierra Leone you run some four or five miles up the river before you come to the town, and in that town there is a very large coal store capable of holding several thousand tons of coal; the harbour is narrow, and, therefore, can be easily defended; therefore this is another point from which we could send our cruisers forth to see our commerce safely across the ocean. On the opposite side there is Barbadoes, with ample coal accommodation, and well defended, and ships from there would see our commerce safely across the Doldrums. Three years ago, on the 2nd March, 1877, Mr. Robinson, a member of the Legislative Council of Natal, stated in this room that there was coal 180 miles from the coast—"coal of the very best steam quality." I ask what has been done towards bringing that coal to the coast? I believe up to the present time nothing has been done. This is a subject of great importance. Another point is our telegraph communication. I suggest it should be by the sea, as the present line of communication could be cut one hundred times a day. The telegraph should be laid from the Cape *via* St. Helena, Ascension, a branch to Sierra Leone, and home; let us be independent of other people, and not lay our wires where they may be severed. I now come to the very important question of mercantile ships for war purposes. Mr. Donald Currie described the ship *A* with iron decks covered with wood. The frames 2 feet apart. These decks are fully capable of bearing any strain you choose to put on

<sup>1</sup> Are merchants prepared to build such vessels? I see by the *Standard* from one-fifth to one-fourth of steamers built yearly are lost every year. So merchants will have an opportunity. Would it pay the merchants to hire these vessels in peace? If not, I say let the Admiralty use them as transports and man them.

<sup>2</sup> The Colonies to contribute their quota, say in proportion to their exports and imports, and to have their *share* of naval patronage.

<sup>3</sup> It may not be generally known that the Excise duties exceed by 3,000,000*l.* the Army and Navy expenditure.

<sup>4</sup> He is no *true patriot* who would starve the efficiency of either service.



them. As regards armament, Captain Pim tells us that ship A will capsize. Why? She is 43 feet beam, and to imagine that with ten 64-pounder guns of 64 cwt. such a ship will capsize is, in my opinion, an impossibility. If she is a vessel to protect our commerce she would not carry cargo, but coal; and, therefore, that would give her stability. The water ballast in her bottom would also give stability. I do not quite approve of the way in which Mr. Donald Currie mounts his guns; he has the guns on truck carriages. The 64-pounder gun should not be mounted on a truck-carriage, but on a slide and carriage—a form of mounting which gives the gun crews great confidence in their guns; but if you place that gun mounted on a truck-carriage with a slippery deck, and the ship in motion, the gun will turn round and look you in the face, and, after a few rounds, she will begin to dance. I should like to say one word to shipowners on the subject. I quite agree that shipowners should receive some support from the Admiralty. They should from time to time be informed as to what the Admiralty requirements are, and should carry them out. The pivoting gear and breeching shackles should be actually built when the ship is built, and if the ship is thus prepared, it will not be a question of three months or three weeks, but within seven days that ship could be fitted out with her armament, and be on the high seas doing her duty. As regards such ships being attached to a squadron, I think Admirals would be very glad indeed to have vessels attached to them with the 1,400 or 1,600 tons of coal that ship A can carry, and she can carry more if coal is placed where cargo is now stowed. I am sure an Admiral would give the top of his little finger for two or three such ships which could perform their 12 or 13 knots at an expenditure of 40 tons of coal per day. Then with regard to look-out ships: my father was in the "Unity" in 1805, a frigate which was stationed for nine months off Brest; she had to go in every morning to count the French ships, and see that none had escaped during the night. Long Tom was brought to bear upon them, and now and then a shot came whizzing between the masts. An Admiral would be very glad to have such vessels as ship A for that purpose. It is very important that such vessels should have large coal stowage to perform the many duties of look-out ships, a duty which they would be able to perform equally well at night, as by the aid of the electric light they could communicate with the Admiral at a distance of 8 or 9 miles, and give him timely warning of ships being sighted.

Major FRASER, R.E.: A remark was made just now that might mislead the public with regard to some of the small guns in the Navy. I understood Colonel Hope to say that none of the service 64-pounder guns will pierce armour at all. That is not exactly the case. The 64-pounder wrought-iron gun is now provided with a Palliser shell, which will certainly penetrate 4 or 5 inches of wrought iron at short ranges. I do not pretend to enter into the naval aspect of the subject, but in discussing the question, the 6-inch B.L.R. gun of 4 tons should be considered as being the gun of the present. This gun at short ranges will penetrate 10 inches of iron. Small gunboats with more than 10 inches of iron plating are, I am told, rare, and should thicker armour become usual in this class, a moderate increase of weight in the guns to be used will probably meet the increase. I was delighted to hear the prospect that Colonel Hope holds out with regard to guns. I trust he will succeed, and after he has done so, I hope he will also provide for the infantry as good a weapon in its degree as he promises to the artillery.

Sir HENRY BARKLY, G.C.M.G., K.C.B.: As a member of the Royal Commission, appointed to inquire and report as to the best means of protecting our Colonies and our maritime commerce, I do not like to remain silent on this occasion, although, as the Commission is still engaged in taking evidence, and is not likely to arrive at any conclusion for some time to come, I need hardly say that I am not in a position to take part in this discussion. Sir Henry Holland and myself, however, attended here with the sanction of the Commission for the purpose of hearing Mr. Donald Currie's lecture the other day, and listening to the discussion to which it has given rise, and I now rise for the purpose of saying that the Commission are fully convinced of the great importance of the suggestions that have been made as to the necessity of arming some of our first-class steamers to co-operate with our Navy in the event of war, and they feel deeply indebted to Mr. Donald Currie for having taken so opportune a moment to raise the question, and to elicit the opinions to which we have listened.

Admiral SELWYN: I am going to take a somewhat broader ground than anything we have heard this afternoon. I desire that Mr. Donald Currie, who has come to consult us as professionals, should receive a professional answer; and I think any professional answer ought to be given on a broad statement of the facts of the case. At sea, as a question of history, there are two games which may be played; one is that of the lion, and the other is that of any of the long-eared animals who trust to their heels. Our merchant steamers are eminently qualified to play the part of running away, and it is their business to do so. We must not mistake the question, and think that because shipowners are very patriotic, and are willing to undertake any trouble and expense that may help the country in case of difficulty, that therefore we should be satisfied to have what must at least be only comparative efficiency instead of perfect efficiency. If the "Iris" were put against any one of these boasted vessels—and we must consider that a vessel similar to the "Iris" might be in an enemy's hands—there is no difficulty in any foreign Power getting an "Iris" built in this country, and even if in this country there were difficulties in their way, they might go across the water, and find many speculators ready to build. I say if the "Iris" were put against these ships, she could take as many of them as she could catch, and if they had 64-pounder guns, having found their heels insufficient, and having attempted to play the part of the lion, without the lion's skin, they would find themselves in the position of being clean shot through and through, from stem to stern, or *vice versa*, and sunk directly they dared to fire. In the ordinary case a vessel of war meeting a vessel such as this at sea would say, "She is an inoffensive merchant ship; we won't do her any harm, but she must submit;" but should she fire a gun, that instant she invites attack, and no consideration of humanity will prevent her being sunk directly, then and there. You have to consider what you are doing when you adopt such an idea as this. You are putting on the lion's skin without the lion's power. There is a much wider question as to how we are to provide the very wheat which it is acknowledged we should want during war without these merchant steamers. Do you imagine that a convoyed fleet of such steamers could go across the Atlantic at 11 and 12 knots an hour without ensuring competition from neutrals immediately? Could you afford to go across slowly? Would any shipper of wheat or grain on the other side of the Atlantic prefer an English vessel going 12 knots to a German vessel going 15? The real, the great danger is this: that in the present state of maritime warfare, one cruiser at sea like the "Alabama" creates such a scare as long as she is not caught—and no number of cruisers could ever absolutely ensure her being captured—she would create such a scare that commerce deserts your flag altogether. The United States commerce was equal to our own, and it collapsed and disappeared in two years of inefficient war; it came to us, and commerce once so transferring its allegiance never goes back. This is the real danger against which you have to guard; and it is not by any volunteering, however good, that you can meet such a danger. You must be known not only to have the ships which can control the ocean, but also those which will prevent fleets from ever coming out, which will at the very incipient building of a steamer for such a purpose, watch the port in which she is to such an extent that she shall be captured when she comes out. True, it is a very difficult operation. A dark night or a heavy fog puts all our best precautions entirely at fault, and we cannot prevent a steamer going out whenever it chooses. With wind and tide and sailing vessels we should have known how to do it exactly, but not so now with steam. I say distinctly, a merchant steamer owner will do best if he simply follows the path he is now pursuing—make the coal supply as efficient as possible, get as high a speed as possible with as low an expenditure of coal as possible. I speak more confidently on that part of the subject because I have a letter in my hand from a vessel which has gone for ten days on 1 lb. of coal expenditure per indicated horse power per hour. Let our shipowners, then, go forward in the elaboration of the best ships for commercial purposes. If, when war is declared, Government find that they cannot in any other way get as good ships, it will serve their purpose to buy at the time and on the spot that which they can fit for their own purposes; but I doubt very much whether that will replace such ships as we ought to be building for the Navy. The employment of naval Officers is a question to which attention is very

wisely drawn, but again I question very much whether it can be solved by employing old naval Officers, or by their amalgamation in any way with the mercantile marine. I think, on the contrary, the First Lord's speech in Parliament the other day shows distinctly what the evil is and how it is to be met. We have opened wide the door during the past twenty years for young Officers into the Navy, until all promotion in the Navy is stagnated, and we are now going to shut it again, and admit only fifty-five naval cadets per annum. What supply of naval cadets will that give you if you have occasion for a large fleet? Nothing at all. By the French plan, every young boy whose parents intend him to go to sea, is first sent into the Navy for four years to learn the discipline, and, having had the advantage of good schooling and good companionship, he then goes at the age of sixteen to the mercantile marine with the associations which he has learned in the Navy, both of discipline and gunnery, and many other things which will help him, should he ever be required to go back to the Navy. By that means they have a reserve for the Navy of Officers of all classes, and also ensure the more perfect education of the mercantile marine; the two things will be co-incidental. In this paper we have a proposition in fact exactly equivalent to that of "Volunteers *v.* The Army." If it were the fact that our country was willing to accept our volunteer service as merely auxiliary to the professional service, we should be able to go on admirably well; but unfortunately people are always pressing for a reduction of the fully-equipped professional, in order to bring forward the half-equipped volunteer, and that is always the tendency of that beautiful pruning of the Estimates which yearly takes place in the government of the country, always substituting something that is not the real thing, because it is a little cheaper at present, whatever it may be in future. I think that no such principle should be applied to our Navy, and I should be very sorry, knowing how much depends on thorough efficiency, on being up to the latest requirements of the Navy itself, if any such thing were to be done. I am sure that Mr. Donald Currie will join with me in saying, we shall be very sorry to see any such feeling going abroad. The probabilities of progress are such that we should be very unwise to ignore them. What we want is the last development of science, and that which it can give us at the time when it is to be put in operation. As for convoying, as a gallant Officer near me remarks, that is as extinct as the dodo, the whole system has been exploded by the use of steam. You might just as well set the old stage-coach to convoy a railway train, and expect that people would go by that train. I am sure we wish Mr. Donald Currie every success in the right direction of his efforts, which is a consideration of what can be done in employing the mercantile marine as part and parcel of the defences of the country, but I must join issue with any proposition that goes an inch beyond; and I say every one of us ought to press forward, to the utmost of our power, that kind of constant experimental research which results in steady progress, never throwing back any suggestion because it is too new. I have lived to see a great many suggestions, which were at one time so criticised, and which yet have brought out great results. One of those suggestions, the Perkins engine and boiler, three years ago was the subject of a report to the Admiralty by a Committee appointed by the House of Commons, and yet the experiment has never been officially tried, and it is left to the private efforts of men who have at heart the development of progress, for other reasons, to bring the matter forward? Should that be the case? Is a Committee appointed for nothing? Ought we to have at this day steam engines on board our ships which use more than two pounds of coal when we might have them using one pound? Ought we to have boilers that blow up, when we might have boilers that won't blow up? Ought we to have boilers that wear out, when we might have boilers which would be practically everlasting? This is distinctly due to the utter abhorrence with which everybody who introduces a novel idea is viewed in the departments of this country, because he is regarded as a disturber of the public peace. This is the real evil which should be conquered, and if such a Council be established, as was foreshadowed by one of the previous speakers, it ought to be allowed to entertain, inspect, and review, as we do here, to a certain extent, every project brought forward, in order to sift out the good and to refuse the bad. This has not been done yet, and it will only be done by the proper union of mechanical, engineering, and professional talent of whatever kind; and so long as we believe in a certain set of gentlemen, who come and tell us, "We have

"not done the best, it is true, but we have done as well as we knew how; and we "are satisfied with that;" we shall have ships which are not safe; for as Captain Saddler, the Commodore so-called of the State line of steamships, said the other night, "If they are light they heel over with the slightest breeze;" and so long as you choose to put a board set on edge in the water they will not be safe, and will certainly not carry heavy guns on the broadside. Under certain conditions, if you choose to go very fast at sea in smooth water, that is the best way to do it; but if you are to make a ship that is to encounter all weathers without damage and without loss, for God's sake do not build such things as you do now.

The CHAIRMAN: General Stephenson and Gentlemen,—I can assure you when I accepted the suggestion made to me, that I should fill the chair upon the present occasion, it was not with any idea of offering to such an audience as that which I see in this theatre any remarks of my own upon a very technical and difficult subject. At the same time I hardly like to let this interesting discussion close without assuring you in a few simple words how much its importance has impressed itself upon my mind. I think Mr. Donald Currie is very much to be congratulated upon the reception of his paper, the more so because it has been nearly a week before the public, and the members have therefore had ample time to pick out any flaws or weak points which his scheme might present. I was struck by the observations of the gallant Admiral who addressed us very eloquently on the former occasion, and who dwelt with great animation upon the disastrous results to the Navy of party government. Well, I am not going to enter into party politics, particularly at a moment when the political atmosphere is so bracing and invigorating as it is now; but I am bound to say that, in my humble opinion, it is not so much party feeling from which these questions suffer as from the apathy and indifference of a large section of the English public. All of us are brought up to believe that "Britannia "is to rule the waves," but having accepted that proposition, we are very much inclined to remain content with a vague idea that Britannia lives somewhere near Whitehall, and the best thing to be done is to leave her to rule the waves after her own fashion. The great advantage of these discussions seems to me to be that it brings forward in a very practical light the different points by which these issues are affected. I think nobody can have attended either this debate or have read the literature on the subject of late without a slight feeling of uneasiness with regard to our maritime position, whether we think of the enormous extent of our dependencies, covering as they do somewhere between 7,000,000 and 8,000,000 square miles, or whether we think of the extent of our trade, and above all things upon the immense proportion of that trade which concerns the food supply of this country, a proportion which increases year by year, for in the last twenty years the amount of corn and grain imported into this country has more than doubled, and there is every indication that that progress will continue. Under these circumstances may we not view anxiously the position of a country which, like ours, depends to such an extent upon a foreign food supply? Now, besides that, we have to consider our responsibilities. It is difficult to discuss that question without getting upon politics, but our responsibilities do not appear to me to be diminishing at all, and we have been told on very high authority indeed within the last few hours, that the voice of England is to have an ascendancy in the councils of Europe. If that is to be the case we must take care that we are fit to maintain the position which is thus assigned to us. With regard to the resources of our Fleet, I am certainly not going to enter upon a disquisition on that subject, but I think it is evident even to a civilian that there are one or two points of weakness in our position. One of those is the comparatively small number of cruising vessels which we have at this present moment; another is, of course, the fact that these costly ironclad men-of-war are liable, like any other complicated machines, to get out of order, and that when they do get out of order they may remain, for want of graving docks, for want of facilities for repairing damage, in a state of helplessness a great many thousand miles away from home. Well, that is a very serious consideration. Then, when we turn to the case of other Powers, what do we find? I hope that our absolute maritime superiority remains unchallenged, but our relative maritime superiority certainly has diminished, unless I misunderstand the figures which have been quoted within the last few years, so that I say we are bound at all events, whatever our own leanings may be, to consider very

attentively such a scheme as that which Mr. Donald Currie has placed before us. In order that that scheme, or any scheme of the kind may be carried out, you require, I understand, two conditions. One of them is that the Government upon its side should take properly preconceived measures; the other that shipowners on their side should be ready to facilitate the action of the Government. Now as to the measures which might be taken on the part of the Government, there is, I understand, a disposition upon the part of the Admiralty to admit in principle the necessity of depending to a certain extent upon the merchant service. That was stated the other evening in Parliament, and if there is a difference between the responsible chiefs of the Admiralty and my friend on my left (Mr. Currie), it is that they would propose to defer till the actual outbreak of hostilities those steps which he (I must say I think with considerable reason on his side) should wish to see taken, not at the actual time of the emergency, but before it had actually overtaken us. I understand that before a vessel can be available for such purposes as those contemplated by Mr. Donald Currie, her decks must be of a certain strength, she must have certain coal-carrying capacity, and that there must be bulkheads which will divide her into compartments. If we wait until the outbreak of war, and then turn round and endeavour to procure such vessels at the last moment, I am almost inclined to fear that before they were fitted out, we might find that our commerce had received a blow of a very disastrous nature. With regard to the principal points touched upon by Mr. Donald Currie, there is only one as to which I would venture to say a word. It did occur to me that one or two of the speakers who addressed us seemed to suppose that he contemplated that these merchant steamers, armed as he proposed, should successfully resist men-of-war or gunboats belonging to hostile Powers. Now I understood from him when I listened to his paper, that he contemplated rather that they should be capable of resisting not vessels of that kind, but vessels of the same class as themselves, which were likely to be equipped by a hostile Power very much for the same purpose that he has described. There is another important question which has been touched upon, and which seems to me to be a very serious one, which is the question of men and Officers, and there is no doubt Mr. Donald Currie in his reply will explain that point perhaps a little more fully, because there does seem to be rather a difficulty in seeing where the necessary number of Officers and men are to come from to supply these vessels. I do not like to detain you longer. I would only echo the feeling which has been expressed so well by several speakers who have addressed you, the feeling that Mr. Currie as a leading shipowner has set an admirable example in coming forward in connection with this question. He mentioned to us in his paper the case of Russia, and he described the steps which were taken by the Russian Government to induce the good people of Moscow to find the sinews of war for a project of this kind. We may be quite sure if ever the occasion arises it will not be necessary to apply such pressure to the great shipowners of this country, but that they will come forward cheerfully, cordially, as he has done, and do their best to assist the country in its hour of trial.

MR. DONALD CURRIE: My Lords and Gentlemen, I feel very grateful for the kind expressions which have been used with regard to this paper and for the patience and consideration which you have shown to me. I had taken the best means of obtaining information. I am not acquainted with the use of artillery, nor am I a sailor nor a strategist; I am simply a shipowner, and one observing the current of political affairs abroad and at home, and willing to assist in some measure with suggestions directed to the security of the country.

I can assure Captain Pim that in taking the steamship A, I have not drawn an imaginary vessel. She is a typical steamer now in existence, the name of which has not been mentioned in this theatre. She is not ten times but eight and a half times her beam. In my paper I stated distinctly that there were a good many steamers in the mercantile marine, with equally low consumption of fuel, able to steam 12 to 14 knots, but which would not be available when required; and I suggested they were not all worth having as fighting ships. There are vessels which have a want of stability, but ship A is sufficiently stable. As regards the number of men, I earnestly sought in my paper, but as briefly as possible, to urge upon you all how necessary it was to have ready for emergencies an adequate supply of seamen, and I am of opinion that we are anything but supplied for a sudden emergency. These ships

will have a value, apart from their fighting qualities, if prepared in time, in respect of the men who will be engaged by the shipowners; and as to expense, I venture to say it would cost the country next to nothing. As regards a money payment to the shipowner, I think that an arrangement might be made for picked ships. I do not speak of my own vessels, I refer to the best steamers which may be obtainable. Twenty of these vessels might be held ready during peace; it would not cost much more in wear and tear, interest, and depreciation, than the expense of keeping up one or two ironclads or a couple of cruisers, such as you have in the Navy. Reference has been made to what a one-gun gunboat can do; but what about her coal-carrying power? I am quite aware a cruising steamship with a large gun may be as powerful as another steamer with a greater number of light guns. I do not disparage such vessels. Many of the steamers of the B class might be fitted to carry one or two guns of good penetrating power.

Colonel Hope spoke of the 64-pounder in ship A. I can assure him I did not manufacture the plan either for the use of 64-pounders or the carriages which Admiral Lethbridge speaks of. The Admiralty themselves fixed that merchant ships, if armed, should have such fittings. They planned that class of gun and gun carriage. I could hardly do better than take their decision. The guns may turn round and look us in the face, as Admiral Lethbridge says. I would think the proper course is for the Government to settle the armament, and it would not be difficult to arrange, fit the slides in time, and make ready for the gun when mounted.

Admiral Hoskins gave us some excellent remarks, based upon what he had experienced in Australia, and I think his observations assist very materially the argument of my paper, which is that the mercantile marine should be made use of in good time to be effective, otherwise we are in danger of having our food supplies cut off, and if you have not got the steamers required in the Navy then you must employ the best thing you can find in their place.

Lieutenant Campbell asked if I could tell him how it would be possible to have a class of steamers to act as floating coal stations. There is nothing to hinder that. It is a simple and common-sense thing to do, and has been carried out over and over again. You would take merchant vessels of 1,500 to 2,500 tons, carrying 2,000 to 3,000 of coal, to distant stations. How are you to have coal, say at Singapore, Bermuda, the West Indies, the Cape, and elsewhere, during war, unless you send it in steamers?

Captain Long said that I was slightly in error in stating that "nothing was really done." If he will read a few words further on in the paper, he will see what I meant. I was referring to what the Admiralty did not do at the time they made their enquiries, and I said in the next line—"The inquiries of the Admiralty have been elaborately carried out, but nothing was settled or brought to a definite point." The answer to my statement is not that the Admiralty put fittings up for thirty steamers in the dockyards; there was no definite plan arranged with shipowners, and there is none yet arranged. With regard to the most valuable article written by Admiral Sir Spencer Robinson, and to which reference was made as having appeared in the *Nineteenth Century*, I would only say it was a singular coincidence that at the same time my humble paper was making its appearance; I never had the pleasure of meeting Sir Spencer Robinson, and I did not then know of his article; but I am very happy to find that so distinguished an Officer has brought the subject before the public.

Lord Alfred Churchill spoke of the "Grantly Castle," but ship A is not the "Grantly Castle." I have sought in my paper to keep away from any appearance of a personal aim in what I had to say. As to that vessel (A), which Admiral Selwyn tells us could be caught by the "Iris," I would say that the "Iris" would hardly beat her in speed; and as the "Iris" can only carry 3½ days' coal at full speed, there is hardly a comparison. Ship (A) might steam from here to the Cape, back to England and back again to the Cape without buying a ton of coal; and she would do that with a speed of 13 knots. That vessel is not a year old, and within a few months a foreign Power offered one-third more than her cost to buy her as the best type of a fighting cruiser they could find. The owners did not sell her to that foreign Power; our Government knew all about it.

Commander Gilmore said it would cost 20,000*l.* to convert each merchant steamer into a fighting ship. Really it would do nothing of the sort. It would not cost 5,000*l.*, or even much less. It was suggested by one speaker that I thought ship-owners had been badly used in not getting paid for their expenses. It was not my wish to express any such idea. It is not proposed that money shall be paid for the past. If the public service requires arrangements for defence, there must of necessity be pre-concerted plans; and the Government can easily find out what it would cost. But let them take the best boats and not have any unless the most suitable. The "Hecla" cannot be considered the type of a cruiser. She cannot steam 12 knots. The "Hecla's" length is ten times her beam. I do not say that in disparagement; the question raised is whether that is the best type of boat to be bought and employed as a cruiser. I might say one word of a technical character, for I made the experiment and had it tested by the Government. Supposing compartment A in ship A was full of cargo and you allowed 30 per cent. for the extra weight, caused by the water entering that end and filling it, the vessel would only be immersed 2 feet 4 inches extra aft, and her speed would not be altered. If pierced in the bow she would draw 21 feet aft and 25 feet 8 inches forward, and yet would be quite seaworthy and able to steam about 11 knots. I speak of this by way of illustration. The Government will do well at its leisure to lay its plans of defence; and if it be determined not to have merchant steamers or that they cannot be usefully employed, that they should then make the Navy sufficiently strong in cruisers to protect our commerce and to assist the fleet.

The CHAIRMAN: I am sure I shall have the permission not only of the Council of this Institution, but of every member of it, and also of the public, to thank Mr. Donald Currie for the trouble which he has taken in preparing and reading this admirable paper. He has brought to bear upon his subject a great amount of practical knowledge and experience, and an acquaintance with details which has manifested itself not only in the paper itself, but in the reply to which we have just listened. I ask you, therefore, to permit me in your name to thank him cordially for the honour he has done us.



NAMES OF MEMBERS who joined the Institution between the 1st January and the 31st March, 1880.

LIFE MEMBERS.

Rogers, J. P., Captain R.A.	Gosselin, B. M. O. H., Lieut. Coldstream Guards.
Byng, Hon. L. F. G., Lieut. Royal Horse Guards.	Portland, the Duke of, Lieut. Coldstream Guards.
Innes, F. N., Captain R.A.	Legh, N. E. C., Lieut. R.N.
Stewart, W. D., Lieut. Bedfordshire Militia.	Hunt, Henry E., Major Robin Hood Rifle Volunteers.
Russell, Lord Herbrand A., Lieut. Grenadier Guards.	Wright, Thomas, Surgeon Robin Hood Rifle Volunteers.
Baker, C. Arundel, Captain 89th Regt.	Johnstone, H. Campbell, C.B., Major-General.
Sanford, G. E. L. S., Lieutenant-Colonel R.E.	

ANNUAL MEMBERS.

Morgan, Horatio H., Lieut. R.M.L.I.	Showers, H. F., Captain 1st Punjab Infantry.
Truell, R. H., Major 53rd Regiment.	Dixon, M. C., U.C., C.B., Major-General, late R.A.
Foster, Hubert J., Lieut. R.E.	Martin, H. H. N., Captain 16th Regt.
Moody, J. M., Major R.M.L.I.	Dundas, Colin M., Commander R.N.
Tanner, Arthur F., Lieut. 3rd Essex Artillery Volunteers.	Wetherall, H. A., Captain Coldstream Guards.
Farnell, Henry, C.B., Lieut.-Colonel 3rd Buffs.	Wiltshire, J. H. B., Earl of, Lieut. Coldstream Guards.
Curtis, J. G. C., Lieut. 43rd Regiment.	Knatchbull-Hugessen, E., Lieut. Coldstream Guards.
Keyser, Frederick C., Captain 7th Royal Fusiliers.	Renny-Tailyour, H. W., Lieut. R.E.
Heath, F. C., Lieut. R.E.	Winn, Rowland, Lieut. Coldstream Guards.
Grubb, J. L. C., Lieut. 16th Regiment.	Compton, Henry, Captain 3rd Essex Artillery Volunteers.
Griffith, J. H. K., Lieut. 23rd Royal Welsh Fusiliers.	Armit, R. H., Lieut. R.N.
Dowse, E. C., Lieut. 45th Regiment.	Sutton, George F., Lieut. Coldstream Guards.
Dowse, R. T. E., Lieut. 12th Regiment.	Muntz, F. E., Captain 2nd Devon Militia.
Cameron, H. H. A., Captain 16th Regiment, Adjutant Hants Militia.	Dacres, S. H. P., Commander R.N.
Pelham, Frederick S., Lieut. R.N.	Thrupp, Morton F., Captain 45th Regt.
Tilly, J. C., Captain 16th Regiment.	Barrett, H. P. M., Lieut. 1st Somerset Militia.
Nisbet, G. D. M., Captain 16th Regt.	Mackellar, Alex. O., M.D., M.R.C.S., Surgeon R.N. Artillery Volunteers.
Campbell, Charles, Lieut. R.N.	Wynne, A. S., Major 51st Regiment.
Legard, J. D., Captain R.A.	Warry, Arthur, Captain R.A.
Browne, A. G. F., Lieut. 3rd Goorka Regiment.	Seton, Alex. D., Captain 8th Lancashire Artillery Volunteers.
Burn-Murdoch, John, Lieut. R.E.	Thrupp, Arthur T., Captain R.N., A.D.C. to the Queen.
Drury, Edward D., Captain 25th Kent Rifle Volunteers.	Seymour, E. H., Captain R.N.
Greville, Hon. A. H. F., Lieut. 60th Rifles.	
Sturdee, F. C. D., Lieut. R.N.	
Morgan, F. C., Captain R.A.	
Irvine, A. G., Lieut.-Colonel Canadian Militia.	

## OCCASIONAL PAPERS AND NOTICES OF BOOKS.

---

This portion of the Number is reserved for Articles, either Original or Compiled, on Professional Subjects connected with Foreign Naval and Military matters; also for Notices of Professional Books, either Foreign or English.

It is requested that communications or books for review may be addressed to Lieut.-Colonel Lonsdale Hale, at the Royal United Service Institution, Whitehall Yard, London, S.W.

---

### THE MILITARY POSITION OF ITALY.

From the (Augsburg) *Allgemeine Zeitung*, 22nd February, 1880.

By Major ARDAGH, C.B., R.E., D.A.Q.M.G., Intelligence Branch, Horse Guards.

THE "*Italia Irredenta*" party agitates unwearingly for the "liberation" of the "unemancipated" provinces of Trentino and Trieste; i.e., it eggs on the Italians to war, and has so far been successful, that Austria has, in consequence, considerably reinforced her garrisons in the South Tyrol, and has taken in hand the completion of her fortifications on that frontier.

In the actual military conditions of the two States, it might not appear so hazardous for Italy to attack the Austrian Monarchy, when it is considered that she is fortunate enough to be able to reckon on a powerful ally, in a position to draw off the mass of the Imperial troops to a distant theatre of war, and hold them there. But if, as has been set forth in one of our late numbers, the South Tyrol is very much exposed to be outflanked from the eastward; and if Italy also has done much towards the completion of her military system, the conditions subject to which her forces would take an offensive rôle are, in general, not particularly favourable; and, apart from numerical inferiority, the offensive and defensive power of the young State still suffers from serious defects. Considerable time is still required to remedy them, so that the advice and the pressure exercised by the *Irredenta* party may occasion complications and even considerable dangers for the Italian Government.

To depict these conditions of the military strength of Italy, her strong and weak sides, as disclosed in the rich material of the various works which have lately appeared, is the object of these lines.

The field army of Italy which would be available for operations on the expiry of the two and twenty days required for mobilization, consists of ten army corps, each of which is made up of two divisions and a reserve. Each division comprises 12 battalions of infantry in 4 regiments, together with 2 squadrons and 3 batteries, each of 8 guns. To the reserve belong one regiment of Bersaglieri of 4 battalions, a cavalry brigade of 8 squadrons, and 4 batteries of corps artillery; together with engineers, a pontoon train, and transport, &c.

The guns are either the Krupp 9-cm. or a 7-cm. bronze breech-loader. The fighting strength of a corps is about 27,000 men. Until 1878, special cavalry divisions did not exist. A peculiar feature of the Italian Army are the Alpine battalions. Recruited in the Alpine valleys, they are quartered always in the districts in which they are raised, and are maintained at their full establishment of 5 Officers and 250 men. They are, consequently, soon ready to move, and serve to cover the development of the mobilization. There are 10 battalions comprising 36 companies, attached to which are 36 reserve companies, a number which can be further increased to 72. The establishment of the latter is 5 Officers and 200 men. They are composed of the recruits of the active company. 8 mountain batteries of 6 guns each aid in the defence of the mountain passes. They are manned from the 4 fortress artillery regiments, which together number 60 companies.

After the standing army comes the Landwehr. After the Italian soldier has served three years in the active army and six in the reserve (the cavalry soldier five and four years), he is transferred to the *Milizia Mobile*. This body is formed into 10 divisions, to conform to the number of the troops, and has on paper (for neither reservist nor landwehrman is ever called out) a strength of 130 battalions, 30 batteries, 20 artillery and 10 engineer companies; besides the brigade of 8,000 men complete in all three arms allotted to the Island of Sardinia. The Militia is armed with rifles of old systems converted to breech-loaders, of which arms there are 600,000 available. These are, however, to be replaced by Vetterli rifles; and of the requisite 220,000, 60,000 will be ready this year.

The batteries which are fully equipped are armed with old-fashioned bronze muzzle-loaders, but there is, however, a reserve of 144 new breech-loaders for the standing army. To make matters worse, 50 per cent. of the Officers of the Militia are deficient.

The garrisons of fortresses, the troops required to cover the open cities of Naples, Palermo, Leghorn, Taranto—the exposed positions of Sicily—brigandage, &c., would absorb so many from the Militia, that but very few would be available for the formation of reserve divisions, such as were formed by Germany during the war with France.

Next to the *Milizia Mobile* follows the *Milizia Territoriale*, in which the period of service is seven years. This species of Landsturm is not organized even on paper, but in a prolonged war would afford to the military administration a productive source from whence to fill up the ranks of the Army; for among the ranks of the "*territoriale*" are to be found 200,000 trained soldiers.

Like the German *Ersatz* men and the French *deuxième portion*, Italy also possesses a *seconda categoria*, whose period of instruction is fixed at 150 days nominally, but is generally limited to 40 or 50. Five contingents of this second category belong to the standing army, and furnish 232,000 recruits. As the nine contingents which form the standing army and reserve number 498,000, the gross total available for the organization of an Army mounts to the considerable figure of 730,000; and if the requisite number of Officers could be found, new formations on a large scale might easily be made, for there are 440,000 Vetterli rifles disposable.

The liberal complement (4 Line Officers and 1 Reserve Officer per company) of Line Officers is 750 short of the establishment, and the Militia wants 1,700; although in Italy not only the one-year volunteers, but also the non-commissioned officers after 12 years' service, obtain commissions in the reserve.

A not unimportant numerical reinforcement, upon which Italy can securely reckon in case of a national war, are the Volunteer Corps, which in 1866 numbered 40,000 men.

Glancing over the aggregate of the Italian Field Army, which, with its

280 battalions (each 820 strong), 120 squadrons (of 120 combatants), 848 guns, and 108 Alpine companies, numbers about 250,000 bayonets, and 14,400 sabres, the small proportion of cavalry is striking.

This is explicable, on the one hand, by the poverty of the land in horses; and, on the other, by the fact that the plains of Upper Italy, with their rich vineyards and mulberry culture, their rice fields, &c., as well as the mountainous districts of the Apennines and Alps, scarcely admit of the deployment of large masses of cavalry. Should the contest be confined to the plain of the Po, and to the districts of the Tyrolean and Carinthian Alps, this slight provision of cavalry might suffice; but the want will make itself apparent, if the Italian Army, with a view of bringing about the secure possession of the already conquered district of the South Tyrol by the conclusion of a peace, is forced to seek an objective in the interior of Austria, at Vienna or Pesth. For although frontier provinces may be overrun, peace is often brought about only when the victorious invader stands before the unprotected centre of national life. In her efforts to gain the Tyrol and Istria, Italy should therefore contemplate the possible need of offensive operations of a much wider scope. Hence, an invading army advancing from the Adriatic and the Pusterthal on Vienna has need of a strong cavalry force to secure itself on the side of Croatia and Hungary against the valiant and active horsemen of the Austro-Hungarian Army. Now not only does Italy not possess an adequate number of squadrons, but these units, even on their peace establishments, are always short of their complement, thus making a deficiency in the gross of the cavalry arm of some hundreds of horses. These wants, too, are hard to remedy; for Italy, simply on account of her poverty in horses, has hitherto had to supply the needs of her Army by purchase abroad, especially in Hungary—a source which, as well as North Germany, is liable to be suddenly closed against her.

This want in serviceable riding and draught horses is a point of special interest with regard to the capacity of the Italian Army to undertake operations in the field. The number of effective horses and mules in the country covers, indeed, the actual requirements of the first line of the Army, and the transport columns appertaining to it, amounting to 37,000 horses and 22,000 mules; but for the train in second line draught animals are wanting, and the expedient of road locomotives or traction engines has therefore been resorted to. Upon hard level ground, such as the excellent roads in the valley of the Po, these engines are very useful, but they can only ascend with difficulty inclines of 1 in 100; they require a large supply of water, and consequently need that the district they traverse should be rich in springs and streams; and in the frequent sharp turns of mountain roads a subdivision of the train drawn by them becomes requisite, and consequently they could hardly be used in an offensive operation in the valleys of the Drau and Save. The whole system of maintaining a supply of provisions, &c., from the rear would therefore become very precarious, and the offensive would thereby be cramped—disadvantages which, in an advance over the steep and barren Karst district, or in a halt upon it, might occasion a total discontinuance of the supply of provisions, if the railway, which certainly would have been destroyed, could not be put into working condition.

Besides the deficiency in Officers, the weakness in cavalry, and the insufficiency of teams for the trains, another unfavourable condition is to be observed in the delay in mobilizing, which arises from the slight capabilities of the Italian railways, and the peculiar composition of the regiments. From motives of a political nature, and in order to impress the conception of a common fatherland and bond of connection on the very heterogenous elements of the lately unified State, no localization in the provinces has been adopted as in Germany, but every regiment is made up of equal proportions of Lombards and Sicilians, Piedmontese and Romans, &c. The whole country is

divided for this purpose into five zones and eighty-eight military districts, from the first of which each regiment receives every year a like proportion of its contingent of recruits. For the infantry regiments, each zone furnishes a district, five consequently in all, from whence the contingent of its recruits is drawn; and in the special arms they are furnished from eight or nine such districts. Inasmuch as, in case of war, the regiments receive all their own men back again, this system of distributing the recruits renders the smooth development of the mobilization uncommonly difficult.

The latter operation is conducted in the following manner:—Within forty-eight hours after the receipt of the order, the foot regiments must be ready to march off on their peace footing to the point of concentration of the Army; having arrived there, they receive their reserve men, who have been fully equipped and sent forward by the Commandants of the military districts. These district commands, double as numerous as the German Landwehr district commands, have consequently to do the whole work of the mobilization. The equipment magazines of the infantry and Bersaglieri reserve are in their charge, as well as those of the Militia; they have to requisition the horses and mules, to embody the militia and to dispose of the second category—an overburdening which can only produce confusion. Artillery and cavalry only fill up at their stations and put themselves on a war footing in their garrisons.

These regiments should be ready to march on the seventh day, the batteries in the "second formation," *i.e.*, with six guns. On account of the difficulty in railway transport, both regiments of Engineers and most of the regiments of Artillery are stationed in Upper Italy and Tuscany, where, likewise, on account of the abundant barrack accommodation in Lombardo-Venetia, six of the ten army corps are located.

From the calendar for mobilization, and from the debates in Parliament, the following information has been derived:—

1st day.—Issue of orders.

2nd to 7th days.—Collection of rolling stock of railways. Transfer of the Alpine battalions from those parts of the frontier which are not menaced. Commencement of transport of infantry and Bersaglieri to the theatre of war. Summoning up men on furlough. The first batches of reserve men probably come in on the 6th day.

8th day.—Dispatch of the reserve men for filling up artillery and cavalry.

9th to 15th days.—Dispatch of the infantry reserve men to the theatre of war.

15th day.—Completing the batteries to eight guns.

15th to 22nd days.—Completion and dispatch of the trains.

22nd day.—Commencement of transport of enrolled militia.

The mobilization, and the forward movement or concentration, are thus closely interwoven, the latter being dependent on the enemy in some measure. The first opposition, executed with feeble forces, may be met by the Alpine battalions. More serious enterprises on the part of the two Austrian corps, which will be the first to take the field, may be anticipated after the 8th or 10th day, earlier than which no portion of the Austrian Army can be mobilized, and will be opposed by the Italian 3rd and 5th Corps, stationed respectively at Verona and Bologna, each numbering from 10,000 to 12,000 bayonets; and some days later perhaps also by the 2nd and 4th Corps from Milan and Piacenza. A general offensive movement, however, which might be undertaken by an enemy already mobilized, on the 15th or 16th day, would catch the still concentrating Italian Army in the full activity and confusion of augmentation by the reserves, for the most part without transport or ammunition columns, the roads covered with detachments marching to join their regiments, the railway stations full of trains unloading, and the Verona-Treviso line blocked with a mass of trains. The lines of the Tagliamento and of the Piave, which are tolerably strong, and whose few bridges

can be easily protected by extemporised fortifications, and the Bar Forts to be constructed in the Alpine Valleys, must help the Italian Army through the difficulties of this period, otherwise the concentration must be effected more to the rear, behind the Brenta or the Adige.

It remains, however, questionable whether the mobilization and concentration (*Strategische Aufmarsch*) can be completed within the twenty-two days, for on the one side the Italian railways, which do not belong to the State, but to three great private companies, have yet to undergo the crucial test of actually transporting bodies of troops on a grand scale, and on the other the whole execution of such a task upon them has to contend with numerous hindrances.

In general terms there are four lines of railway available :—

1. Turin, Milan, Verona, Treviso.
2. Coni, Cremona, Mantua, Verona.
3. Naples, Rome, Bologna, Mantua.
4. Reggio, Bari, Ancona, Bologna, Ferrara, Padua, Treviso.

The upper station lines have only short sidings, which in lieu of the military trains of 90 to 100 axles usual elsewhere, will only admit of 57 axles. The line along the Adriatic coast is over long sections exposed to the fire of a hostile fleet, and subject to be blown up by daring enterprises undertaken by small vessels of light draught; indeed the whole traffic may thus be interrupted for a long period. The transport of the 9th Corps from Bari, and the 10th from Palermo must then be effected by means of one of the two or three transverse lines which connect the railways lying east and west of the Appenines, thus passing into the districts traversed by the trains carrying the 7th Corps from Rome and the 8th Corps from Naples, and naturally occasioning fresh complications and more waste of time. Further, the passage over the Appenines from Pistoia to Poretta will only admit of trains of 40 axles on account of the steepness of its inclines, a disadvantage which will be removed by the construction of another and better cross line from Pontassieve to Imola. Finally, the rolling stock is said to be insufficient, and 100 engines are wanting.

As regards transport by sea, the 79 steamers of the navigation companies can carry 70,000 men and 8,900 horses. This means is less adapted to a rapid movement on the Tagliamento on account of the tedious operations of embarkation and disembarkation, especially at Venice, and on account of the length of the journey, than for a landing on the Dalmation or Albanian coasts, as suggested by the Italian propaganda.

Should the Italian Army meet with a defeat, and be driven back under the shelter of its fortresses, its prospects in this direction are not the most brilliant. The advanced line of defence is formed by the Tagliamento, the Piave, and the Brenta, which, when the Bar Forts projected in the Alpine defiles at the upper courses of these rivers have been built, may be held for some days. Then comes the strong line of the lower Po, the Adige, and the Mincio. A whole row of fortresses lies along this line, but almost every one of them is defective in the modifications and improvements rendered necessary by modern artillery.

Venice, an important maritime fortress, situated far from the mainland, and only connected with it by a long railway bridge, and by the *tête-de-pont* of Malghera, can offer little support to the land army.

Verona, the sally-port of the Tyrol, was strengthened by the Austrians with forts on the west and south sides, but on the north was only secure against being stormed. In connection with Pastrengo and Chiusa it closes the upper valley of the Adige well, but needs remodelling, and almost turning round, so to speak. If we are not mistaken this was discussed during the last year. Moreover, the forts at Verona belong to a period when the modern changes in artillery and fortification were still in their infancy.

For the completion of the fortress of Mantua, which is so important in connection with Bologna for the defence of the line of the Po, nothing has been done; a *tête-de-pont* on the Po is wanting.

Bologna, which as an entrenched camp, is not only of importance in connection with the defence of the Po, but is of the greatest value as a position in front of the Appenines and their defiles, is totally neglected.

It has indeed an enceinte secure against escalade, but the ramparts of the outer line and of the advanced forts are in ruins, and are dominated by heights situated too close to the body of the place. There are some small Bar Forts of no consequence on the roads to Spezzia, and on the passages over the Appenines.

Rome is skilfully fortified according to modern principles, and is thereby not only secured against enterprises from the sea, but is converted into an important nucleus for the defence of Central Italy. Thirteen new forts, of which half are already finished, and the others in progress, engirdle the ancient city walls, which are proof against escalade. The forts are semi-permanent earthworks, with masonry bomb-proof casemates, and the larger ones are armed with 28 heavy guns. Before Rome, if it is equipped as a strategical fortress, a victorious Austrian Army must in any case make a halt, and commence a new phase of the campaign.

In the defence of the middle Po, Piacenza also comes into consideration. Its works are well preserved, but of an antiquated system, and its *tête-de-pont* is extremely weak.

Peschiera, the starting point of an offensive operation directed against Riva, is in the same condition as when it was taken over by the Italians in 1866. According to recent information a fort is to be erected at Malcesine, where the North Italian frontier joins the Lake of Garda. It will form a port for the Garda Flotilla, which now consists of three paddle steamers and four gunboats. Troops landed here may be employed to outflank the Austrian fort of S. Nago.

To recapitulate the whole, the principal lines of defence, on the Po and the Appenines are entirely wanting in the necessary points of support for an army fortified according to modern requirements, *i.e.*, in bridge heads, in bar forts, and in entrenched camps.

As against a hostile fleet the condition of affairs is as follows:—The coasts of Italy are in general not favourable for a landing, but many of the great emporiums of trade situated in large bays, and with good anchorages, are open to the attack of an enemy:—Leghorn for instance, which possesses a good but badly fortified port:—Naples, where the coast for a considerable extent admits of landing from large vessels:—Taranto, whose excellent harbour is easy to fortify if money were forthcoming:—Palermo, likewise, and most of the Sicilian ports. And moreover in Southern Italy and Sicily the people are somewhat inclined to insurrection, the ferment of Bourbonism still enduring among them. The disadvantage of the exposed position of Naples is still further enhanced by the proximity of the island of Ponza, whose excellent harbour affords a good anchorage for a hostile fleet. The same may be said of Elba, whose six unprotected harbours would afford a favourable base of operations against Genoa and Leghorn. In the wars of England against the First Napoleon, these islands became frequently the points of support of the English Fleet. On the Adriatic coast also there exist suitable positions. Its northern half is unapproachable by large ships, on account of the shallow offing, but the numerous small ports of Ortona, Pescava, Rimini, &c., afford to small and quick vessels localities suitable for surprises directed against the railways; and since the port of Ancona is now unadapted for large ships on account of its sanding up, this former military harbour now affords little protection to the open coasts. Exposed in like manner to hostile enterprises is the very useful roadstead of Manfredonia, whence the bifurcation of the Foggia line can easily be destroyed; and the good harbour of Brindisi. A



rich field for enterprises on either a large or a small scale is here offered to the Austrian Navy, particularly during the Italian mobilization.

The Italian Fleet which will have to protect these open points, and eventually to close the Straits of Otranto, numbers 13 heavy fighting ships, viz., 1 ram, 9 armour-plated frigates, 2 armour-clad corvettes, and 1 armoured gunboat, besides 49 smaller vessels, some of which are not on the effective list. There are 4 armour-clad ships in construction, among them the colossal "Duilio," which will be ready this year, and 2 smaller vessels. There is further a special Torpedo Corps.

In the Mediterranean this fleet is based on the military port of Spezzia, which is excellently fortified both by land and sea; and in the Adriatic on Venice, the main entrance channel to which is being dredged out to a depth of 9 metres (30 feet).

The other coast fortresses all suffer more or less from considerable disadvantages. Ancona, strong on the land side, but weak towards the sea, has been abandoned as a marine establishment. The old defences of Genoa are weak on the west and on the sea side, and the latter would be unable to shelter the crowded and close-built city against a bombardment, for which purpose floating batteries such as the "Duilio" will have to be employed. Gaeta alone is strong, and as a secure anchorage for a fleet indirectly covers Naples. This city and Genoa, &c., will fetter the movement of the fleet in a maritime war.

The Austrian Fleet, available for attack or defence, numbers 11 armour-clad and 46 smaller vessels. It has only one or two emporiums of trade, and but a short extent of coast to cover, and has therefore more freedom of action and consequent superiority in that respect. The steamers of the "Lloyd" company are at its disposition.

The Austrian land forces are well known. They comprise 540 battalions of line and reserve, 245 battalions of Landwehr, 354 squadrons, 1,600 guns; an excellent supply of rifle shots, of horsemen, and of horses is available, and above all the superiority which the memory of so many heroic campaigns in Italy bestows.

Let us hope that both nations have not resolved to sacrifice the flower of their youth on the battle-field.

---

#### THE RUSSO-GERMAN FRONTIER IN 1880.

WHEN the territories of two great Powers are conterminous, however closely connected the reigning families, however intimate the relations between the two peoples on account of a supposed permanent similarity of interests or on account of a temporary alliance to gain some object of equal importance to both, the rulers of each nation must feel that such a state of harmony between near neighbours is not likely to be everlasting, and that they will be only acting in obedience to the dictates of common prudence if they provide betimes for the day when that harmony will be disturbed, and when circumstances arise—as will surely be the case sooner or later—to convert the dear friends into bitter foes. Precaution and timely preparation are especially needful when the boundary between the two States is rather artificial than natural. Since the settlement of 1815 Prussia and Russia have been in the position above described. The former nation, released as it had been with the help of its ally from the French yoke and still quivering with agony from the effects of its sufferings, actuated by sentiments of gratitude and at the same

time conscious of its own comparative weakness, was for many years afterwards satisfied to play the part of a faithful and humble friend towards its gigantic neighbour; yet even in those days of dependence Prussian statesmen ventured to show that they were not inclined to be quite at his mercy, and after carefully feeling their way lest they should offend Russian susceptibilities, began to prepare a barrier against possible aggression by renewing and strengthening the fortifications of Thorn, as we shall presently see, one of the most important points in the line of defence. As the nation increased in strength the Prussian Government gained confidence and showed its independence by continuing the work of fortification along its eastern frontier, always, however, taking pains at the commencement of each new construction to repeat its protestations of friendship towards the State against whose possible enmity it was providing.

The long intimacy between Prussia and Russia was never seriously disturbed until after the former developed into the German Empire. During the Crimean War Prussia maintained her neutrality, the sympathies of the ruling classes, though not of the people at large, being with Russia. During the last Polish rebellion the Prussian Government again gave evidence of devotion to that of Russia.

The latter more than repaid her neighbour for these good offices by the attitude which she in turn maintained in 1866 and in 1870-71, and the alliance between the two States seemed firmer than ever.

But the time was fast approaching when the relations between them would be sorely strained. The mighty German Empire had meanwhile inherited the position formerly held by Prussia with regard to the Empire of the Czar, but with no occasion for, and with no intention of, playing the subservient part to which Prussia had for so long a time submitted. On the contrary, suddenly raised as it had been by its own exertions to the first rank amongst nations it was inclined to dictate to all. We are not yet sufficiently acquainted with the secret history of the last few years either to be certain of what really has happened or to form any positive opinion as to what is likely to happen, but we know enough to be convinced that the war between Russia and Turkey and its consequences have seriously impaired the friendship between the former Power and Germany, at the same time bringing the last-named State into closer connection with Austria; also that there is a strong feeling of animosity in Russia against Germany, because the German Government is believed to have aided the Western Powers in depriving the victor in the late war of the principal fruit of his victories and in preparing obstacles against his further encroachments. This feeling has given rise to violent attacks on the part of the Russian press and to equally violent replies by German writers. The mere fact of such a paper war having been permitted by two Governments perfectly able to prevent it had they wished to do so naturally caused serious apprehension, leading many to think that war was imminent. Externally, however, things have to a great extent quieted down, but a feeling of insecurity still exists; and it is therefore not surprising that the eyes of soldiers in all countries should be directed towards that North-Eastern German frontier which may perhaps ere long be the scene of a great struggle; still less surprising is it that Officers of the nations most immediately concerned, and of one contiguous to both and almost as much interested in the question as either should be reviewing the condition of affairs on the frontier and discussing the relative prospects of success in the event of war.

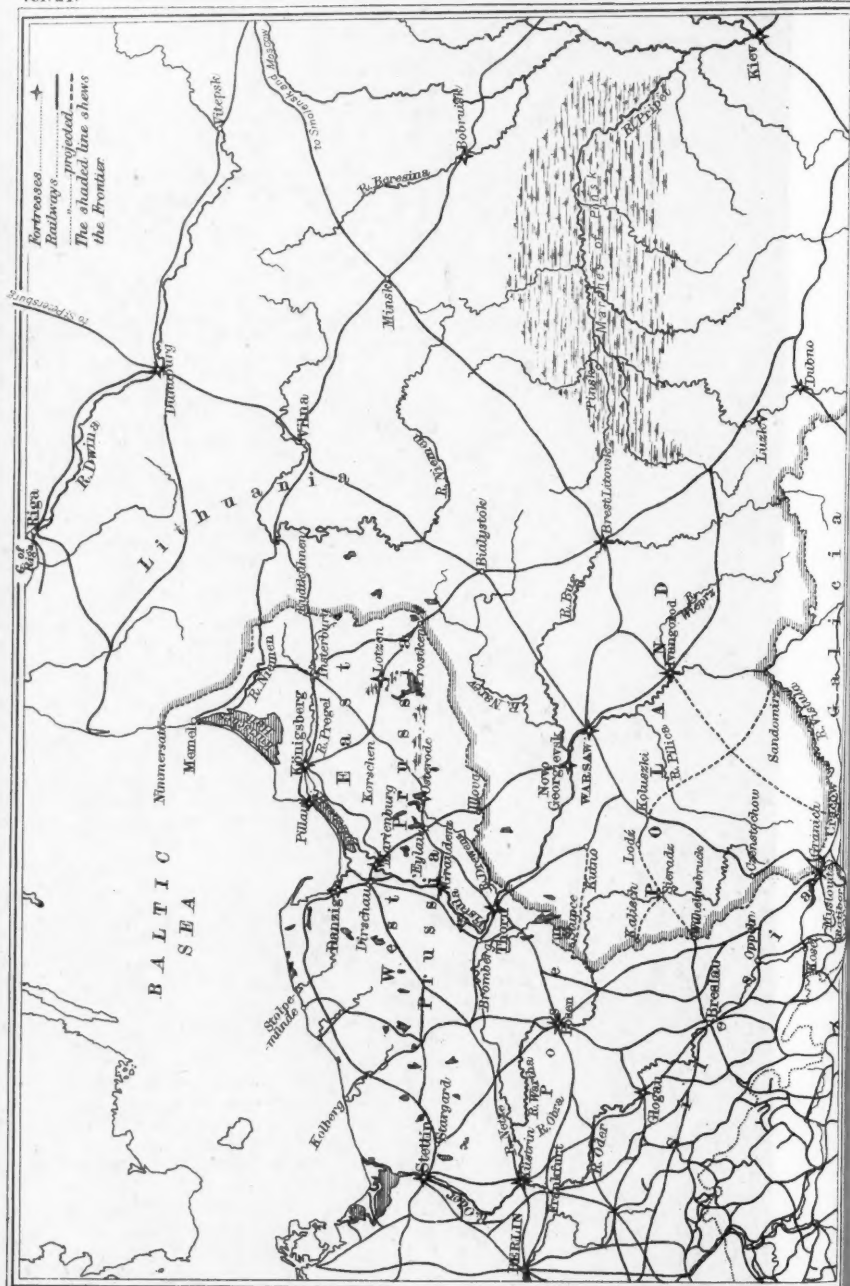
We are not acquainted with any production of a Russian pen upon the subject, though doubtless there are such, but we have before us two interesting studies which appeared towards the end of last year; the first at Vienna, by an Austrian Officer, Captain Kirchhammer, and entitled "*Deutschlands 'Nordost-Grenze'*" (the North-Eastern Frontier of Germany); the second at Berlin, under the title of "*Die Befestigung und Vertheidigung der Deutsch-*

r-  
ts  
en  
ad  
i-  
ng  
of  
in  
e-  
er,  
on  
se

ed  
he  
he  
ng  
of

he  
he

ld  
ed  
ar,  
mt  
y,  
yst  
ed  
at  
to  
sia  
e-  
st-  
ng  
n-  
in  
les  
nt  
by  
ed  
so  
ras  
rn,  
at  
ch-  
eat  
ely  
in  
he  
.  
he  
st-  
na,  
ds  
at  
ch-



"Russischen Grenze der Deutschen Armee dargestellt von einem Deutschen "Offizier" (The Fortification and Defence of the Russo-German Frontier reviewed for the benefit of the German Army by a German Officer).

We propose to present to our readers a short description of the frontier, of the principal fortifications which defend it on each side, and of the lines of communication between the frontier and the interior of each State, drawing largely upon the two publications above-mentioned for our information, and giving in conclusion the views of the two authors, which it is interesting to compare, as to the strategical and tactical advantages on each side for purposes of attack and defence.

No one can look at the map of Europe without being struck by the extraordinary configuration of the Russo-German frontier, which is identical with that established in 1815 between Prussia and Russia, and the outline of which was determined by historical rather than by geographical considerations. The old Kingdom of Poland, which has since 1815 formed part of the dominions of the Czar, is driven like a huge wedge (200 miles<sup>1</sup> in thickness) into the body of Germany within 200 miles of its heart (Berlin); whilst the advanced provinces of Germany enfold Russian Poland like two mighty arms, the left and longer one (East Prussia), extending some 200 miles; the right one (Silesia) some 70 miles behind its foremost point, the latter arm being prolonged for a further distance of near 200 miles by the Austrian province of Galicia. The extremity of Germany's longer arm is, however, not less than 500 or 600 miles from the heart of Russia, whether you consider that heart to be St. Petersburg or Moscow.

At first sight this position would appear to give Russia great offensive power; and so it would, if things remained now as they were in 1815; but as we have already had occasion to notice, Prussian statesmen were never blind to the danger and took early steps to remedy it. Their plans have in later times been carried out systematically, whilst much less has been done on the other side; and we shall see further on how the natural geographical conditions of the frontier have been modified by art so as to alter greatly, if not entirely to reverse from the strategical point of view, the relative position of the two Empires.

The total length of the frontier line, without reckoning its smaller windings, is about 750 miles, measuring from Nimmersatt (N.) to Myslowitz (S.). Throughout the whole of this long extent of country there is hardly a hill on either side of the boundary except in Southern Silesia. There are, however, some geographical features of importance for defensive purposes. Such are the series of lakes in East Prussia which to a great extent cover the south of that province; the marshes within Russian territory along the upper course of the Narew; the Drewenz, a navigable tributary of the Vistula, which joins that river just above Thorn after serving for about 40 miles as the boundary; the Vistula itself, the lower part of which is valuable as a second line of defence for Germany, whilst the middle portion covers the main Russian line; the marshy region of the Obra, in the province of Posen, and the large swampy forests, which however form no continuous line, but which spread at intervals between the Warthe and the Upper Vistula. The best natural protection is afforded by the nature of the soil, generally of deep sand and impassable for heavy vehicles except along the highways, which are comparatively few in number. Proper materials for road-making are scarce, so that though the principal highways are good the cross-country roads are hardly practicable in bad weather. (The student of military history will be reminded of the "boue de la Pologne" to which Napoleon was fond of attributing his want of decisive success in the early part of 1807.)

"Hence," as Captain Kirchhammer remarks, "certain communications

<sup>1</sup> Throughout this paper the distances are given in English miles.—L. G.

"have in this district an importance which, as a rule, only applies to roads  
"in high mountain regions."

It is evident that fortifications will play a more than usually important part in the defence of a frontier of this nature. Before, however, enquiring into the work of the military engineer, let us see what the railway engineer has done to make the frontier on each side accessible, remembering that under the conditions of modern warfare a good system of railway communication is perhaps more essential to the defence of a State than a chain of fortresses.

Germany is, thanks to the foresight of her statesmen, very well off in this respect.

*German Railway System.*—In the north four main lines lead from the interior to the Vistula.

1. Berlin, Stettin, Dantzig.
2. Berlin, Küstrin, Dirschau.
3. Berlin, Küstrin, Bromberg.
4. Berlin, Frankfurt, Posen, Thorn.

A line connecting the terminus of these four main roads runs along the left bank of the Vistula and parallel to it from Dantzig to Thorn.

There are three railway bridges over the Vistula within German territory :

1. At Dirschau-Marienburg.
2. At Graudenz.
3. At Thorn.

Besides the connecting lines above-mentioned, there are many others more to the rear (three of which run to the sea coast) affording the most complete transverse communication between the great main roads.

Two of the latter cross the Vistula and are prolonged to the furthest extremities of East Prussia.

1. Dirschau, Marienburg, Elbing, Königsberg, Insterburg.
2. Thorn, Jablonowo, Deutsch Eylau, Korschen, Insterburg.

From Insterburg one branch runs to the northernmost German town, Memel, and two branches to the frontier at Eydtkuhnen and at Prottsken.

Further back a transverse line from Königsberg crosses No. 2 East Prussian main line at Korschen, and also runs to Prottsken ; another from Marienburg by Deutsch Eylau to the frontier at Jlowo, whilst a short branch connects the bridge at Graudenz with No. 2 main line at Deutsch Eylau.

The three lines which run to the frontier are there connected with Russian railroads.

The only line which actually runs to the frontier in the long stretch between Thorn and Mysłowitz (about 250 miles) is that from Breslau to Wilhelmsbrück. Perhaps, as "ein deutscher Offizier" remarks, the construction of such lines is omitted lest the Russians should be tempted to make lines in prolongation through the railwayless district, opposite that part of the frontier where communications are much required for strategical purposes. At a short distance from Thorn the German lines unite with the Russian railroad which goes to Warsaw ; at and about Mysłowitz with the Austrian line leading to Cracow and with another Russian line leading to Warsaw. There is direct railway communication between Thorn and Mysłowitz, all along the frontier and at a distance of from 10 to 20 miles from it. This frontier railroad is connected with the main lines in rear by two lines from Posen (1. Posen-Gnesen ; 2. Posen-Jaroczin) ; by two from Breslau (1. Breslau-Kempen ; 2. Breslau-Kreuzburg) ; by one from Oppeln (Oppeln-Dossowski) ; and by several from Upper Silesia, where there is a perfect network of railways, due to the mines which abound in that district.

Again a line runs from Frankfurt by Glogau, Breslau, and Oppeln to the furthest extremity of Silesia, and another about 40 miles in rear, also from Frankfurt through Liegnitz, Neisse, and Ratibor. These lines unite Silesia with the heart of the Empire, and are joined together and with the frontier

line by numerous branches. There is communication also between Berlin and the rearmost of the lines just mentioned at three different points, without going through Frankfurt, namely, at Guben, at Sagan, and at Liegnitz.

Taking into consideration the inferiority of Germany to Russia at sea, an inferiority which is likely to continue for some time to come, the German Government has done wisely in providing its maritime frontier with as good railway communication as that given to the eastern frontier, for although the excessive shallowness of the water all along those shores is in itself a great protection against hostile descents, yet there are here and there certain vulnerable points, communication between which and the interior is necessary for military reasons. Hence a grand coast-line has by degrees been constructed right away from Schleswig to Memel, passing through Lübeck, Stralsund, Stettin, Dantzic, and Königsberg.

The section of this line from Stettin to Memel has already been mentioned as No. 1 main road leading to the Vistula, and continued through East Prussia.

Such is the railway system of the eastern provinces of Germany; and thanks to the complete communication thus established within the provinces themselves, and between them and other parts of the Empire, it would be easy to subsist a large army within them without injury to the people, particularly as though the country is not fertile throughout, rich fields alternating with sterile tracts, it yet, on the whole, produces both in cereals and in cattle more than is required for its inhabitants. The railways in Eastern Germany are all State property, which is of course an advantage for military purposes.

All the lines are single except the following:—

Berlin, Küstrin, Königsberg to the frontier.

Berlin, Stettin.

Berlin, Frankfurt, Liegnitz, Breslau, Mysłowitz.

The gauge of the German railways is 4' 8½".

The principal bridges on the frontier lines are prepared for mines. A certain portion of the carriages are provided with shifting axles so as to be used on the Russian railways, the gauge of which (5') was made wider than that in use in Germany as a precaution against invasion.

*The Fortifications on the German Frontier.*—Let us now examine the fortifications of the German north-eastern frontier, commencing with Memel, the northernmost point. "The small strip of land which stretches northwards "between the Russian frontier and the Kurisches Haff" is separated from the "rest of the province, not only by that piece of water, but also by the Memel " (or Niemen) river, which forms an important military obstacle. In the "northern part of this strip of land, and close to the mouth of the Kurisches "Haff, is Memel, a town which has made great progress during the last few "decades, and has now attained a position of considerable commercial "importance. At the entrance into the Haff known as the 'Memeler Tief,' "strong coast forts have been constructed answering all modern requirements; "provision has also been made for laying torpedoes. Memel itself is un- "fortified, and as it would necessarily be left to itself it would probably be "occupied by the enemy if the German Army were reduced to the defensive. "Even the fortifications at the mouth of the Haff would be unable to with- "stand a combined attack from land and sea, but if vigorously defended they "might hold out till a change had taken place in the general situation, and "thus contribute to the expulsion of the enemy from the neighbouring "district. Moreover, the importance of an occupation by the enemy of the " 'Kurisches Haff' should not be exaggerated, this inland sea becoming, even "near its mouth, so shallow that only gunboats of very light draught can "penetrate to any distance."<sup>1</sup>

<sup>1</sup> Ein deutscher Offizier.



South of the Kurisches Haff, about 90 miles from the frontier and on the Pregel, is Königsberg, which has been made into an entrenched camp of the first class, being surrounded by thirteen detached forts of the most modern construction and pushed well to the front. These works extend to the mouth of the Pregel, thus securing the navigation of the Frisches Haff, the entrance of which inland sea is guarded by the little fortress of Pillau, of itself of small importance, but sufficient in combination with some strong coast batteries, provided with Grusen cupolas and with a system of torpedoes, to fulfil its object.

Königsberg cannot be completely invested unless the assailant succeeds in forcing the entrance of the Frisches Haff, which, until this is done, would enable the defender to keep up his communication with Dantzig. Captain Kirchhammer considers the works of Memel, Pillau, and Königsberg, together with the two Haffs, and the rivers which run into them, as one vast fortress of which Königsberg is the key. He remarks that to complete it two forts should be constructed, one near Wehlau, commanding the Pregel and the Alle, and the other near Labiau, covering the Deime, the outlet of the Haff and the communication with Memel. "At all events," says "ein deutscher Offizier," "Königsberg would bring the invader to a standstill, unless he were strong enough to leave a corps behind to invest or besiege it, and could count upon effecting a junction on the Vistula with another army which had meanwhile been advancing along that river." He adds in a note, that a Russian siege of Königsberg would be facilitated by the fact that their principal engineer depôt is at Dünaburg on the Königsberg-Petersburg railway.

The southern portion of East Prussia, for about 120 miles, is well protected by the chains of lakes and marshy hollows which extend from near the Pregel to within 30 miles of the Vistula.<sup>1</sup> Good roads are very scarce in this region, for ever rendered famous by the campaigns of 1807, and the two principal highways through it are blocked by the works at Lötzen and Osterode, which also command railways.

Nature has done much to strengthen this part of the German frontier, leaving but little for the engineer to do.

We now come to Thorn, commanding the Vistula near its entry into German territory, a strategical point the extreme importance of which was at once recognized by the Prussians when it came into their possession in 1815, and has been much increased of late years since it became the point of junction of four great railways. Consequently the fortifications have latterly been much extended and strengthened, the enceinte having been enlarged and eight great detached forts being in course of construction; five on the right bank and three on the left bank of the Vistula: 5,280,000 thalers have been voted for these works, which are to be completed this year. Thorn will then be an entrenched camp with a double bridge-head, a formidable post both for offence and defence.

Northwards of Thorn, right away to the sea, a distance of about 100 miles, the Vistula forms a barrier over 100 yards wide between the detached eastern provinces and the body of the Empire, the Dantzig-Thorn Railway running parallel to the river and along its left bank. There are bridge-heads at Graudenz and at Marienburg, which serve to protect the railway bridges against a *coup de main*, but which are not capable of withstanding a serious attack. At the mouth of the Vistula is Dantzig, an important seaport with nearly 100,000 inhabitants, communicating with Königsberg and Pillau by the Frisches Haff, and for that reason as well as on account of its situation in a low tract of country, easily inundated and cut up by numerous watercourses, very difficult to invest.

<sup>1</sup> It should be remembered, however, that the winter is very severe throughout the whole of the region under notice, and that the lakes and most of the rivers and water-courses are frozen hard in that season, ceasing then to be military obstacles.—L. G.

It was taken by the French in 1807, and from them in 1813, after a six months' blockade, followed by two months' open trenches. Its fortifications have been much strengthened in modern times, and it is now a strong fortress.

South-west of Thorn, and at the distance of about 80 miles, is Posen, the capital of Prussian Poland (50,000 inhabitants), opposite the most salient point of the Russian frontier, and about 40 miles from it. Here unite six lines of railway.

1. The great main line from Berlin.
2. From Stettin.
3. From Colberg.
4. From Thorn.
5. From Breslau.
6. From Mysłowitz.

As a great junction point of railways, as a wealthy town, as centre of a district rich in resources, and as being almost the middle point of a line drawn from Dantzic to the extremity of Silesia, the position of Posen is of great strategical importance, and the engineer's art has done much to increase its value.

"Ein deutscher Offizier" says, "When the fortress of Posen was first commenced in 1830, the intention was to construct a citadel (Fort Winiary), and some other separate works simply for the purpose of keeping down the population of the provincial capital in case of a Polish insurrection. It was only ten years later that the idea of also providing against a foreign foe was conceived and acted upon by making a strong enceinte with a couple of detached forts a little in advance of it. When the introduction of rifled artillery came to modify the principles of fortification, the old defences were no longer deemed sufficient, and it was determined a few years ago to surround the place with a wide girdle of strong detached forts, which are now approaching completion, and thanks to which Posen will become a place of arms of the first class."

According to Captain Kirchhammer there are eleven detached forts, the whole of which should be completed this year, 7,023,000 thalers having been voted for this purpose in 1873.

Sixty miles south-west of Posen is Glogau (18,000 inhabitants), a town of considerable military importance on account of its position on the Oder, and as being the point of junction of four railways :—

1. From Cobus.
2. From Frankfurt.
3. From Posen.
4. From Breslau.

The old fortifications, dating from the time of Frederick the Great, have latterly been extended and strengthened, so that Glogau is now quite a defensible bridge-head. It is of the more importance because, between it and the extremity of Silesia, the right flank of the German eastern frontier, that is to say, for a distance of 170 miles, there is no fortress which would be of any value in case of a Russo-German war, for Neisse and Glatz would be out of the sphere of operations. It has often been proposed to fortify Breslau, but as yet nothing has been done, and Breslau remains an open town.

We have now to notice Küstrin (9,000 inhabitants), "On the line Berlin-Posen, situated very favourably at the junction of the Warthe and the Oder. Both streams flow through a wide marshy bottom, the passage of which, except at the bridges under fire of the fortress, is extremely difficult, so that it is not easy to invest the place. The knowledge of the importance of Küstrin in covering Berlin against an attack from the east led to many additions being made to the fortifications from the very commencement of the railway works, but these additions hardly rise to the requirements of modern

"science. On that account, and because the idea of fortifying Stettin was given up, it was determined by constructing several detached forts pushed well in advance, so as to secure the power of debouching on all three sections of the circuit formed by the two rivers, to make of Küstrin an important place of arms which would much impede the advance of an enemy pushing on from Posen along the Warthe."<sup>1</sup> There are six detached forts, for which 4,731,000 thalers were voted. Küstrin is only 50 miles from Berlin.

*The Russian Frontier.*—The old Kingdom of Poland forms the whole of that mighty wedge which, as before stated, plunges into the heart of Germany, being bounded on the north by the provinces of East and West Prussia, on the south by the Austrian province of Galicia, whilst it is faced to the west by Posen and Silesia. "Surface, a vast plain with a mean elevation of 300 to 500 feet above the Baltic, except in the south, where offsets of the Carpathian Mountains rise to 1,000 feet. It is well watered and covered with extensive forests. Chief rivers, the Narew, Niemen, Vistula, Bug, and Warthe. There are many small lakes and marshes in the north-eastern districts. Climate, extreme. Summer, very hot. Mean temperature, 90°. Winter, very cold. Temperature falls to 10° below zero. The country is snow-clad and frozen for five months in the year. Soil, sandy loam resting mostly on granite. Generally fertile."<sup>2</sup>

One remarkable peculiarity of the position of Russian Poland is that it is an advanced post in a great measure detached from the rest of the Empire, being separated from it by the great marshes of Pinsk, which cover a large portion of the district between the Bug and the Beresina, reducing the width of land available for communication between the two portions of the Czar's dominions by at least one-half. The Vistula is the first natural obstacle of any importance which an invading army coming from the west would encounter, and it is along the middle part of that river's course and on the banks of its tributaries that the Russians have concentrated their chief means of defence, as we shall presently see.

*Russian Railways.*—There are only three railways communicating between the line of the Vistula and the interior.

1. Petersburg, Dünaaburg, Wilna, Bialystok, Warsaw.
2. Moscow, Smolensk, Minsk, Brest-Litowski, Warsaw.
3. Odessa, } Brest-Litowski, } Warsaw.  
Kiew, } Kowel, } Iwangelorod.

No. 1 line has branches—

a. From Dünaaburg to Schab, which is to be continued to Tilsit, in East Prussia.

b. From Wilna to join the Königsberg-Wirballen line.

c. Bialystok to the Königsberg-Prottsken line.

d. Warsaw to Jłowo (West Prussia).

Nos. 1 and 2 main lines are also connected between—

Dünaaburg and Smolensk.

Wilna and Minsk.

Bialystok and Brest-Litowski.

The former two connecting lines extend to meet the South Russian railway system. All the main lines from the interior unite, as we have shown, at Warsaw. Only one line from thence crosses the Vistula, soon, however, dividing into two branches, one of which runs down the left bank of the river to Alexandrowo, near Thorn, where it joins the direct line from Berlin, whilst the other runs to Königshütte, in Silesia, and to Gravica, in Galicia, where it meets the German and Austrian lines respectively. The whole intervening space between the termini of the two branches (from point to point, about 150 miles), is absolutely without a railroad. However, says "ein deutscher Offizier," "The

<sup>1</sup> Ein deutscher Offizier.

<sup>2</sup> From Johnstone's "Gazetteer."

"energy with regard to railway construction which has been developed of late years in Russia will soon alter this state of things. Several new projects have recently received the approval of Government, and steps have already been taken, in some cases, for the actual construction, in others for the preliminary surveys. As far as we can learn from the newspapers, it is intended to make lines to the central portion of the Russo-German frontier, namely, from Kutno, on the Warsaw-Alexandrowo line, by Kolo to Slupice in the direction of Posen along the right bank of the Warthe, and from Lodz, which is on a short branch from the Warsaw-Königshütte line, westwards to Kalisch on one side, and on the other by Sieradz to Wilhelmsbrück, where it will join the German line from Breslau. Again, if other projects are carried out, the Russian railway system will be united with that of Austria, a line being contemplated along the left bank of the upper Vistula from Ivangorod to Cracow, and another from Sandomirz to Koluszki on the Warsaw-Königshütte line. A branch is also spoken of on the right bank of the lower Vistula to Rosenberg, in East Prussia. All these additions, however, will be of little effect from a military point of view upon the utility of the railways west of the Vistula, as long as the passage of this river, hence the connection of the railways on its left bank with those from the interior of Russia, is only to be effected by the one bridge at Warsaw. It will be absolutely necessary to build several railway bridges over the river before you can calculate upon concentrating a Russian army on the central and southern portions of the German frontier with the speed demanded by the present style of making war.

"It is deserving of mention, too, that very few of the Russian railways belong to the State; they are in the hands of about fifty private companies, which are, however, in many cases indebted for subventions or for guarantees of dividend to the Government, which has thus gained a certain influence over the management, a fact of importance with reference to the employment of the lines and of the rolling stock for great movements of troops. The Russian Government attains the same end also by encouraging the fusion of companies whose lines are in connection. We believe that the West Russian, and quite lately also the south-western companies, are fused."

All railways from the interior of Russia to the Polish frontier have only one line of rails. The Russians adopted for defensive reasons a measure of very doubtful expediency, to which we have already alluded, namely, that of a wider gauge (5'), for their railways than that habitual on the continent of Europe (4' 8½"). A portion of their carriages, as in Germany, are fitted with shifting axles.

*Russian Fortifications.*—"If," says "ein deutscher Offizier," "we now make a closer examination of Russian preparations for defence against Germany, and if we survey in the first instance the system of fortifications in what was formerly the Kingdom of Poland, we find the tactical centre of this system to be Warsaw, the capital.

"The town itself, situated on the left bank of the Vistula, is not fortified, but is commanded by the strong and spacious citadel, Fort Alexander, which bounds the town to the north, and was originally intended rather to control the native population than to oppose a foreign enemy. The citadel is supported on the left bank of the river by a number of small detached forts (six), pushed forward a few hundred yards, and well calculated to assist in the defence of the capital in combination with the troops which would probably be concentrated about it, and with field works thrown up on the spur of the moment."

<sup>1</sup> The author states in a note that information from native sources about Russian fortifications being very meagre, he has made great use of an article which appeared, in 1877, in "La Rivista Militare Italiana," on "Le piazze forti della Russia."

"The position, however, does not lend itself to effective offensive operations with large masses on the left bank. Two bridges span the Vistula within the fortifications, one communicating between different parts of the town, the other, a railway bridge, between the town and citadel; a small fort on the right bank covering the latter bridge. The neighbouring fortifications of Praga, the suburb of Warsaw, on the right bank, appear to have lost their former importance owing to the manner in which the surrounding ground has been built upon since their construction.

"About 22 miles from the Vistula and at its junction with the Narew, the fortress of Modlin, or according to modern nomenclature Novo-Georgiewsk, forms the strong advanced right flank of the Vistula position. The construction of the existing fortifications of this place was commenced between 1830 and 1840, and may be looked upon as the Russian answer to the Prussian works at Posen. In the fortifications of Novo-Georgiewsk, as in nearly all the more modern Russian works, we remark the same principles of construction as in the so-called new Prussian system, which was so much in favour in Prussia under direction of General Brese in the period between 1830 and 1850, and which reached its most complete development in the enceintes of Posen and of Königsberg.

"The introduction of rifled guns has, as is well known, seriously shaken this system, and has led to very material modification of its principles. The weakness of the works in question in face of rifled guns can hardly be unknown to Russian engineers; but though we have heard constantly of small additions being made to their strength, and though some years ago a widely extended chain of detached works around the place was projected, we yet know nothing of the execution of this plan nor of any really decisive steps being taken to remedy defects, and first and foremost to shelter the numerous and extensive constructions in masonry from indirect artillery fire; a German army would therefore probably find this extremely important place still in much the same condition as, for instance, was Posen before the commencement of the works now in progress at that place, and quite unfit to offer a prolonged resistance against heavy rifled artillery.

"It seems peculiarly fitting to make this remark (which applies more or less to all Russian fortresses) with reference to Novo-Georgiewsk, the said fortress having been entirely reconstructed, and being thus the best sample of the latest development of military engineering in Russia. The unimportant town of Modlin stands on the right bank of the Vistula and of the Narew, is surrounded by a strong enceinte, and has a citadel. A bridge-head has been constructed on the left bank of each river, but so close to them as to be unable in any way to facilitate offensive operations on a large scale. Eastwards of Novo-Georgiewsk the Narew covers for about 20 miles the right flank of the Russian position on the Vistula, being then relieved in this duty by the Bug, at whose junction with the Narew is the little town of Sierock, the fortification of which has been repeatedly, and even as lately as 1876, recommended by the Russian engineer department. The construction of a fortress such as proposed would doubtless contribute greatly to the security of the right flank of the Vistula position, but as yet we do not know that anything has been done in the matter. The fortress of Ivangorod (formerly called Demblin) forms the left flank of the position on the Vistula, about 56 miles above Warsaw, at the junction of the Wieprz with the Vistula.

"The little town stands on the right bank of the latter river and is surrounded by a bastioned enceinte, the only advanced works up to this

He adds that though he has taken great pains to verify the accuracy of the Italian writer, and to add to the details given by him, he must admit that he has not always been able to learn as much as he could wish upon the subject.—L. G.

"time being three earthwork lunettes at a few hundred yards from the body of the place. According to the newspapers, however, an enlargement of the fortifications is actually in progress which would result in the construction on the right bank of the Vistula of four detached forts nearly a mile in advance, and on the left bank of two other forts forming a bridge-head for offensive purposes.<sup>1</sup>

"With the exception of the last named works, which may be employed quite as much against Austria as against Germany, we cannot look upon the engineering arrangements for strengthening the naturally strong position on the Vistula as very imposing.

"Although the importance of the fortifications would doubtless be increased by the presence of a strong Russian army between the Vistula and the Bug, yet we cannot think that a German army provided with a proper siege train would find it very difficult to ruin the works of Novo-Georgiewsk and of Warsaw, thus leaving no advantage to the Russian defenders except that arising from the natural strength of their position. In rear of the centre of the Vistula position, and serving to a certain extent as its reduct, is the fortress of Brest-Litowski. This place, situated at the point where the Moscow-Warsaw railroad crosses the Bug, seems, together with the fortress of Kiew, which we shall notice further on, to be considered by Russian engineer officers as of particular value for the defence of the country, and considerable additions to its fortifications appear to have been ordered at various times down to the latest date. The unimportant town of Brest-Litowski is on the right bank of the Bug near its confluence with the Muchaviec; its fortifications apparently on the new Prussian system extend along both banks of the two rivers, and have been strengthened by four detached advanced forts, constructed with a view to the offensive on the left bank of the Bug. A strong fortified barrack has been erected on an island within the place and serves as a central reduct.

"The strength of Brest-Litowski depends principally upon its position near the western branches of the Rokitno marshes,<sup>2</sup> which extend eastward to the Dnjepr, and by their further extension on both sides of the Pripiet, as well as by their impracticability for every description of military operations, completely separate the northern part of Western Russia bordering on Poland from the southern part thereof which borders on Austria and Roumania. If a German invader after occupying Poland were even to limit his further operations to the region north of the Rokitno marshes, he still would be unable to confine himself to a mere investment or observation of Brest-Litowski; he must needs take it, so that during the subsequent operations his right flank and his communications may be secure from Russian attempts which may be expected from the south.

"A railway connects Brest-Litowski with Kiew and the south-east, thus placing the country along the upper and middle Bug in communication with the richest and most populous parts of Southern Russia, and opening out a store of valuable resources, for the space between the south-western portion of the Rokitno marshes and the Galician frontier is sufficient for the movement of large bodies of troops which would be further facilitated by the existence of several considerable towns in those parts. The importance of this circumstance for active defence has not been unnoticed by the Russian Government, and the Commission for considering the strategical condition of

<sup>1</sup> Captain Kirchhammer speaks of nine forts placed in a circle round the confluence of the two rivers, at a distance of from 2,000 to 5,000 paces from the old fortress, forming a "double offensive bridge-head." The *Golos* of November 7, 1879, quotes from the "Lüblin Gazette," which states that the works at Ivangorod are being carried out with the greatest vigour. The earthworks were already finished, and the contractors were proceeding with the brickwork.—L. G.

<sup>2</sup> Otherwise called Pinsk marshes, said to be the largest in Europe.—L. G.

"the frontier is reported to have recommended, as far back as 1874, the establishment in this locality of a great place of arms, and with that view either to rebuild, according to modern ideas, Lutzk (Michaelogorod), the works of which are of an obsolete pattern, or to refortify Dubno. According to report the Government has determined to make both places into strong fortresses, and it is said that the necessary works have already been commenced. Although these precautions may seem to be directed more especially against Austria, they yet at the same time provide an excellent base for offensive action along the Bug and Vistula, and supposing a German army to be occupying Poland, it can only secure itself from molestation from the south either by another army being placed to block out Dubno and Lutzk, thus extending inconveniently the sphere of operations, or, as we said before, by taking possession of Brest-Litowski. This place therefore fully deserves the high esteem in which it is held by Russian engineers.

"You may go to a long distance from the eastern border of Poland into Russia before meeting with any defensive works. The district, too, north of the Rokitno marshes, although traversed here and there by watercourses running through depressions which are in places swampy, presents no insurmountable natural obstacle to military operations.

"The old fortress of Dünauburg stands at the point where the Warsaw-Petersburg road and railroad cross the Dwina, and on the right bank of that river; the town, which is small, is surrounded by a complete enceinte, with several advanced works, whilst on the left bank is a tolerably strong bridge-head formed by a combination of several forts. The defensibility of this place is much augmented by the marshy nature of the surrounding country, but we have not yet heard that the old works have been remodelled, as they should be, to meet modern requirements. We have already noticed the importance of Dünauburg as a principal engineer dépôt.

"The little fortress of Dünamünde, at the mouth of the Dwina, in the bay of Riga, only serves to protect the harbour of Riga against maritime attack, and may therefore be left out of consideration.

"The next fortress in the district under notice is Bobruisk, about 220 miles south of Dünauburg, and on the right bank of the Beresina, which here joins the Dnjepr. It has a complete enceinte, with a few detached works in advance. The left bank of the river appears to be unfortified, but being commanded by the works on the right bank, it is sufficiently guarded by them for mere passive defence. Bobruisk covers the old high road from Warsaw to Moscow as well as several other important communications which here unite to cross the Beresina, but the Warsaw-Moscow railway is carried over the river at Minsk, 100 miles more to the north. The importance of this fortress in the event of a Russo-German war is much diminished by this fact, and the place is the less likely to be visited by a German invading army, because branches of the Rokitno marsh pervade the whole basin of the Beresina, rendering the region unfit for military movements."

About 170 miles further south is Kiew, on the Dnjepr, which it is hardly necessary to mention with reference to war between Russia and Germany, being quite out of the field of operations, but it is a place of great importance, and it appears that a considerable proportion of the funds at the disposal of the engineer department has of late years been expended on it. Moreover, this is not all. The old fortress of Chotim, on the Dnjestr, has been much strengthened within the last ten years, and has been united to Kaminiac-Podolski by a series of detached works so as to form a large entrenched camp.

Having now given a slight sketch of the country on both sides of the Russo-German frontier with reference both to natural and artificial means of defence, let us see what the Officers from whose treatises we have already so



largely borrowed, think of the chances of a war of invasion undertaken by either Power.

*Invasion of Germany by Russia* ("Ein deutscher Offizier").—Taking Berlin as objective, "We have to consider four main lines of advance for an invading Russian army. It may either move westward from Wilna, on the valley of the Pregel and Königsberg; from Warsaw either in a north-west direction along the Vistula; or west along the Warthe against Posen; or, lastly, south-west against Silesia. The first two lines of advance are favoured by the existing Russian railway system, and afford the opportunity of combining land operations with those of a fleet which will, we may suppose, be conducted at the same time. By pushing forward along the Vistula, the invader would not only gain the advantage of using this stream as an important channel of communication, he might also, if the movement were the main operation and successful, cut off the extensive province of East Prussia with its resources from the other German territories, and join hands with an auxiliary force advancing at the same time along the Pregel. Such being the case, these two lines would appear to be the most favourable for a Russian invasion, and the military resources of Russia would appear equal to the task of taking the offensive in both directions at the same time. We are led to conclude, at all events, that our authorities entertain that opinion, from the fact that in the German preparations for defence it is just this north-eastern portion of the frontier which seems to have been particularly considered.

"A movement from Warsaw westward on Posen would be very tempting to a Russian invader, from the fact that it would lead him by the most direct route on Berlin; but if this line of advance were selected, the invader would have to give up all railway communication with his base and would expose himself to the danger of being taken in rear by diversions either from East Prussia or from Silesia. It seems improbable, therefore, that the Russians will choose this line of operations at least until the before-mentioned railways from Kutno and Lodz to the frontier have been completed.

"Lastly, if they select the line of advance from Warsaw on Silesia they are bound by the existing system of railways to take the direction of Upper Silesia, somewhere about Oppeln; the invading army would there find itself in a country not very well suited to operations on a large scale, and in a district far removed from the main objective; it would, moreover, be exposed to extreme risk of attack from the north-eastern provinces along the Vistula. An invasion in this direction can only be considered probable if Russia were able to count upon assistance from Austria, and wished to act in combination with that Power.

"Such a possibility may, however, be dismissed from our thoughts. The present friendship between Germany and Austria is not merely of a temporary nature, but will, as far as we can foresee, be permanent, based as it is on a just appreciation by each nation of the interests common to both. The principal interests of Austria centre on the Lower Danube, which forms the main artery of the Empire. Here she comes into conflict with Russia, whose struggles for expansion are necessarily in that direction and towards the Black Sea. The interests of the two nations in those parts are difficult to reconcile, and they will continue to be rivals for many generations, the natural tension being increased by the Pan Slavist idea which crops up periodically threatening when it does so to disturb a part of Austrian territory.

"Germany also has an interest not only in the development of Austrian influence on the Lower Danube, but also in maintaining the might of the Empire-State in face of the insecure condition of affairs in the Balkan peninsula; it is therefore the natural ally of Austria eastwards, and the two States are more likely to be on the same side than opposed to one another in case of a war in the East."

We have already, when describing the fortifications which defend the provinces of East and West Prussia, alluded to the difficulties which would impede the direct advance of a Russian army through those countries; let us now see what obstacles a force proceeding from Warsaw down the Vistula would have to encounter.

"A passage of the German frontier by an army following the course of the Vistula along the right bank would not be greatly hindered by the Drewenz, which there forms the boundary, but the close investment or capture of Thorn would be necessary to the success of the movement.

"A further advance northwards along the right bank of the river would then meet with no difficulties, particularly if undertaken in connection with an army operating on the banks of the Pregel. Graudenz is, as we know, no longer of any account as a fortress.

"Its position, as also that of Marienburg, is such that neither fortress has any offensive power, that is to say, they would be of no use in facilitating offensive action on the part of the Germans from the left bank against an enemy in force on the other.

"Although there would be no longer any material obstacles in the way of a hostile occupation of the district on the right of the Vistula, still the enemy would hardly think of crossing the river and of pursuing his operations on the left bank until one at least of the fortresses, Königsberg or Thorn, had fallen into his hands.

"The construction and armament, however, of these strongholds give us good grounds for supposing that if, as may be expected, well and energetically defended they would hold out a long while, and thus give the German commanders time to perfect their defensive measures. If, however, a Russian invader succeeded in crossing the Lower Vistula, he must next take pains to secure, by means of fortifications, the passage over the river, which here forms a considerable military obstacle, and then to render Dantzig innocuous, threatening, as it would, his right flank."

"The enemy would, therefore, after crossing the Lower Vistula encounter difficulties only to be overcome by an expenditure of time which would benefit the German defence. Under these circumstances the invader would do well to consider whether it would not be more judicious to advance from the first on the left bank of the Vistula, the occupation of which close to the frontier would at once be rendered necessary for the purpose of investing Thorn; there, however, he would come at once upon an awkward wooded country, much intersected by swampy bottoms between the Vistula and the valley of the Netze, westwards of the former river, rather an inhospitable region, and further on the defiles formed near Bromberg by the low swampy land between the Netze and the Brahe, that is to say, he would get into a situation not particularly favourable to a large invading army. If he advanced in that direction, too, he would find it very difficult to keep up his communication with the other corps, which we may suppose to be advancing from the east on the Vistula. We may leave entirely out of the question the idea of dividing the invading army on the Vistula and of advancing at the same time along both banks, as to adopt such a course would be to attribute much too great a degree of weakness and indecision to the German leaders.

"In case of a movement westwards from Warsaw on Posen the field of operations would be divided by the Warthe, and particularly by the wide lowlands along its course within Russian territory. North of the Warthe, as far as the Netze, on the frontier of Posen, there is a remarkable water system consisting of a chain of small lakes, which extend from north to

<sup>1</sup> Ein deutscher Offizier.

"south, and are generally united to one another by little patches of swamp. This chain of numerous lakes, which cover the whole district, stands in the way of a Russian invading force and renders the north-east part of Posen much more favourable to defence than to attack. An invader, after investing Thorn, situated only a few marches from the Warthe, and after overcoming all the natural difficulties which here stand in his way, would very soon come upon the fortress of Posen and be brought to a standstill.

"A Russian army advancing on the left bank of the Warthe, where the Prosna, which here forms the boundary, is no serious obstacle, would certainly have to deal with fewer difficulties of ground, but would be diverted in its onward march by the great Obra marsh lying in front of it either on one side to within reach of the fortress of Posen, or on the other side to within reach of Glogau upon the Oder."

"According to the direction taken by the invading army, either northwards on the Warthe or southwards on Glogau, it would have to invest or take either Posen or Glogau. The latter undertaking would doubtless be the easier of the two, and it would, moreover, give the invader some further advantages.

"By taking the direction of Glogau, with his right flank covered by the Obra marshes, he would find no difficulty in penetrating to the left into the fertile district of Middle Silesia, in occupying the open town of Breslau, and in making sure thus of a quantity of valuable resources; it would be much easier to cross the Oder at Glogau than further down, where the valley of that river expands into a broad bottom very difficult to get over; and, moreover, by taking this route the invader would be able to turn Küstrin and to advance in a north-western direction on Berlin."

"The want of railway connection between the Warsaw-Vienna line and the German frontier would make it very difficult for the invader to keep up his communication with his base; and as long as Warsaw remains the only point where the Vistula can be crossed, would expose him to be completely severed from it by a bold German counter-stroke made from Thorn along the left bank of the river.

"The proposed Russian branches from Lodz to Kalisch and to Wilhelmsbrück would only partially remove this objection, which would, however, entirely cease to hold good if new lines were carried over the river above Warsaw from somewhere about Ivangorod and Sandomirz so as to connect securely the railway system in the interior of Russia with the lines leading to the Prussian frontier. This is clearly only a question of time, and to provide for a state of things which would considerably alter the defensive properties of the German frontier it would be well to take into consideration the expediency of renewing the project so often suggested, but never carried out, of fortifying Breslau, and of making this important provincial capital into a place of arms which an invader advancing in the direction supposed could not afford to leave behind him. Lastly, we must notice the possible, but by no means probable, invasion of Upper Silesia, making use of the Warsaw line as far as Czentochau. The enemy would have first of all to encounter the extensive and somewhat impracticable wooded district on both sides of the Malapane and on the right bank of the Oder before reaching the fertile fields of Middle Silesia."

"He would encounter no material obstacle in the way of his occupation of this district and of Breslau, and would indeed meet with no impediment till reaching Glogau. Although the conversion of Breslau into a stronghold would be of great value in the event of an invasion such as suggested, at the same time we must not forget that, were the Russians to take the

"offensive in this direction, the operation would be so eccentric that it would hardly be suitable for the main army.

"From all these considerations we are, it is thought, justified in concluding that under present circumstances the German frontier provinces are sufficiently secured against Russia, partly by their natural conformation, and partly by the art of the engineer. The dispositions made by the latter, except with regard to the forts for mere local defence among the East Prussian lakes, testify to the fact that the Germans do not contemplate the idea of a mere passive defence of the frontier by directly barring its numerous approaches, which would indeed be impossible in consequence of its great extent. If a different course has been pursued with regard to the East Prussian coast, the difference is explained by the fact that it is only accessible at a few points which are not difficult to fortify; further on along the Pomeranian, Mecklenburg, and Holstein shores the more important harbours of Swinemünde and Kiel are the only places strongly fortified, whilst at Kolberg and at Stralsund (in consequence of its connection with the island of Rügen) some of the old works for the immediate protection of these ports were preserved. As regards the rest of the coast it will be defended by movable columns, the operations of which are facilitated by the construction of the complete system of railways already described. We may consider the defence of the territory along the land portion of the frontier as provided for in a similar manner.

"The troops being mobilized in good time, and concentrated at certain important points, may be transported by means of the well arranged German railway system to any point where their presence may seem to be required, and where they may at once take that bold and active offensive so suitable to the German character. Should the enemy get the best of the first encounters, the large places of arms situated on the most probable lines of invasion will give the defeated army the opportunity of taking temporary shelter from the superior force of the invader (who will be obliged to secure himself against these strongholds). It will then bide its time until a favourable opportunity offers for resuming the offensive. At all events, these places of arms, thanks to their own power of resistance and to their situation, commanding as they do important sections of the frontier, will detain an invading force in the border districts long enough to enable the German War Department to collect and prepare for further resistance the considerable forces still remaining available for defence after the first mobilization has proved insufficient."

The German Officer now proceeds to discuss the chances of a German invasion of Russia as follows:—

"*German Invasion of Russia.*—If the object of invading an enemy's country consists in taking possession of as large a portion of the same as possible, so as to deprive the defender of its resources, thereby weakening him and disposing him to concession, it must be admitted that such a plan applied against Russia would not of itself be sufficient. The Russian Empire is of such vast extent that a hostile occupation must needs be confined to a proportionally insignificant part of it, and must be seriously inconvenienced by the numerous and considerable watercourses, by the large and almost impenetrable stretches of marsh and of forest imperfectly supplied with roads, and by the small number and poverty of the inhabitants. The defensive power of Russia depends principally upon these circumstances; an invader must, unless he would meet with the fate of Napoleon in 1812, confine himself to attacking Russia at her most accessible and vulnerable points, where he may strike such blows as will tell upon her power. The Western Powers pursued this course in 1854-55, and Germany would have to act in a similar manner if she took the offensive. One of the most vulnerable points in the north-western provinces of Russia bordering on Germany

"is certainly St. Petersburg, and an attack upon that political and administrative centre would be likely to affect the general result of the war. But the Russian capital is over 500 miles from the frontier; an invading force starting from East Prussia and moving upon it would not only have to cross some considerable streams, and also to traverse defiles through broad tracts of swamp, thus encountering difficulties of various kinds, but it must also extend laterally to an inconvenient distance so as to cover its communications.

"On the left, the side of the coast, the Russian fleet, which would completely command the sea, and which would have access to the numerous good harbours, would menace it and would have to be guarded against, whilst on the right whole armies would be required to give security, forces sufficient to hold their own against the Russian field armies which would probably not retire on St. Petersburg, protected as it is to a great extent by its distance and by natural obstacles, but rather to a flank into the interior of the vast Empire, receiving on its way the numerous reinforcements which would by degrees be assembled.

"And, moreover, should such a plan of invasion be carried out, it would be impossible to hinder the Russians from concentrating imposing forces in Poland, and from thence falling upon the Prussian provinces, whilst the remainder of the host opposed a stubborn passive resistance to the invaders."

"Germany must, whilst standing on the defensive, on the eastern frontier of East Prussia at once take possession of such a large portion of Poland as to cripple the action of Russia on that side. The Kingdom of Poland is the most densely populated portion of the Russian Empire, and is well adapted from the nature of the country for operations on a large scale; the task therefore which would devolve upon a German commander would not be impossible, and its successful completion, entailing as it would a prolonged occupation of the conquered country, might well lead to the attainment of the object of the war. Otherwise it would remain for the German leader to proceed with his further operations according to circumstances, his chances of success being much increased in every way by the preliminary occupation of Poland."

It remains for us now to quote Captain Kirchhammer's views on the prospect of a German or Russian invasion.

After describing the Russian railway system in the western provinces of the Empire, he proceeds as follows:—

"*Russian Invasion of Germany* (Captain Kirchhammer).—The value of these communications as a whole is much weakened by the fact that the two northernmost lines are much exposed in consequence of their situation in close vicinity to the German frontier. The Russian base is certainly not well adapted to military requirements. First of all it is too narrow in proportion to the extent of the German theatre of war; moreover, it is outflanked from the very first; in a word, it is weak. It does not ensure sufficient freedom of movement to a Russian army taking the offensive. With the exception of Czentochau, indeed, its points of *appui* are all defensible positions, but at present only two of these points, Novo-Georgiewsk and Brest-Litowski, are fortresses of real value. Moreover, the base of a Russian invading army would be 'en l'air.' Its right flank would be menaced in the most serious manner from the province of East Prussia, whilst its left would lean on Austria, which from Galicia commands the valley of the Vistula as far as Ivangorod. The friendship, or at any rate the neutrality, of Austria would be, from a military point of view, of the greatest value to Russia in case of a war with Germany.

"A Russian army taking the offensive by the principal line of operations,

"Warsaw, Posen, Berlin, would have on its flank and rear, after passing the frontier, the provinces of Prussia strategically so menacing. Any movement directed from those provinces on the right bank of the Vistula would exert an immediate influence upon the railway communications which are so important, and we may well say indispensable, between Poland and Russia.

"This consideration would oblige the Russian Commander to divide his forces. He would be compelled to operate with a second army against East Prussia, the defensive properties of which have been already pointed out.

"The series of lakes in that province, the marshy country in advance of them about the upper tributaries of the Narew, the line of the Pregel, and of the lower Vistula, the sea coast which does not offer a single point suitable for the disembarkation of large forces, the strong places of Königsberg, Boyen (Lötzten),<sup>1</sup> Dantzig, Graudenz, Thorn; when we view all these defensive elements as a whole, how many points of vantage do they not offer for the defender? What force of attraction to Russian attack, what power of resistance against it?

"Prussian Silesia, on the other hand, appears to be the part of the German frontier the least protected either by nature or by art.

"The rich town of Breslau is completely open. This province is also contiguous to Russian Poland, so that an insurrection in that country can be easily supported by sympathisers from Silesia. Taking count of these circumstances, and of the difficulties which a Russian invader would meet with to the north of the principal line of operations, we may assume that the Commander would be strongly tempted to enlarge his base, if necessary, by operating in Silesia. But can this be attempted without first being master of Posen and of Prussia? The German General could hardly defend Silesia better than by concentrating his forces in the commanding positions of Posen and of Prussia, whence, under shelter of the strong natural and artificial defences, he would turn to their confusion any eccentric operations of the enemy. If we now glance at the country in rear of the border zone, we find to the east of Berlin two watercourses, which are of great strategical importance, the "Netze" and the "Oder." The Netze, running from west to east, forms, thanks to the swampy nature of its banks, and also to its volume of water (it is navigated by steamers as high as Uszcz), a strong line of defence, which gains a special value from its connection with the Vistula by means of a canal, and by the fact that the Bromberg-Küstrin railway runs along its right bank for about 150 miles. The Oder, which below Breslau has a width of from 170 to 280 yards, forms an important line of demarcation, and a good perpendicular line of defence. Besides the permanent bridges at Breslau, Glogau, Frankfurt, Küstrin, Schwedt, and Stettin, there are also some flying bridges over it, but, except where bridged, there are few places at which it can be crossed. The line of the Oder is defended by the fortresses of Kosel, Gross-Glogau, Küstrin, and by the Fort of Prussia at Stettin. Each of the places here named communicate with the interior by several railways, and with one another by lines which are on the left bank of the river, and thus sheltered from attack. It appears from the foregoing considerations, that if Russia assumed the offensive against Germany it would be compelled from the very first to extend its base of operations.

"*German Invasion of Russia.*—The same obligation to a yet greater degree would be incumbent on Germany were that Power to attack Russia. The adoption of a plan of invasion which would admit of methodical extension becomes in this latter case an absolute necessity. A German army would be unable to penetrate into the interior of Russia without being in the

<sup>1</sup> The fort at Lötzten, commanding one of the narrow passages between the East Prussian lakes; that traversed by the railway from Königsberg to Prottsken, is called Fort Boyen, from the Prussian Minister of War who planned the system of defence for East Prussia.—L. G.



"first instance mistress of the basin of the Vistula within Russian Poland ;  
 "and the fact that the occupation of this province must be the first great  
 "act of a German invasion explains the important part which Poland plays in  
 "the defensive system of the Empire of the Czar. Considered with reference  
 "to military geography, the theatre of war on the middle Vistula, forming  
 "almost a regular quadrilateral, with sides of about 200 miles in length, is  
 "complete in itself. Shut in to the north and west by Germany, and to the  
 "south by Austria, it is directly separated from the interior of Russia by  
 "the marshes of Pinsk. Moreover, this separation is not merely geographical,  
 "Poland is also severed politically from the main body of the Empire. It  
 "may be looked upon as always ready to reinforce an invader.

"If we seek for a line of defence behind which the Russians can establish  
 "themselves, and circulate with freedom, we remark at once the prominent  
 "importance of the Vistula, the Bug, the Narew, the Dniepr, and of the  
 "canals which unite these rivers with the Niemen and the Pripet. The triangle  
 "Sierack, Novo-Georgiewsk, Warsaw, must be looked upon as the most  
 "decisive position, as that in fact which, according to Napoleon, commands  
 "the whole of Poland. Its importance comes from the fact that the most  
 "considerable streams in this country form their junction within its precincts.  
 "This circumstance gives a Russian army the power of transferring itself,  
 "whether engaged in offensive or defensive operations, from one zone to  
 "another, and even of avoiding the enemy's attack, as often and for as long  
 "a time as may be necessary. The natural strength of this position has been  
 "further increased of late years by the development which has been given to  
 "its system of communications, and by the construction of permanent fortifica-  
 "tions. Thus the fortresses of Novo-Georgiewsk and of Ivangorod give the  
 "appui to the flanks of the line of the Vistula, in which it was before  
 "deficient, whilst at the same time considerably increasing the importance of  
 "the lines of the Bug, Narew, and Dniepr. The fortress of Brest-Litowski  
 "is an important complement to the defensive system on the Vistula, which  
 "fact was recognized by those who for merely strategical reasons traced the  
 "lines—

"Mohilew-Minsk }  
 "Kiew-Dubno } Brest-Litowski.

"This fortress is intended to cover the fractions of the Russian Army  
 "(which have been separated in their advance by the marshes of Pinsk) on  
 "their entry into the region of the Vistula, and, on the other hand, to bar  
 "against an invader access to Lithuania on one side, to Wolhynia on the other.  
 "It need hardly be said that this fortress adds great strength to the line of  
 "the Vistula. Speaking generally, the theatre of war in Poland is very  
 "favourable to the defender when the watercourses are free from ice ; not  
 "quite so favourable during hard frosts.

"Thanks to the configuration of its frontier, the German base of operations  
 "may envelop the theatre of war on the middle Vistula. The most important  
 "points of the base at once strike the eye ; Kosel, Breslau, Gross-Glogau on  
 "the right ; Posen in the centre ; Thorn, Graudenz, Boyen, Königsberg,  
 "Dantzic on the left. These strongholds contain a sufficient number of  
 "magazines and hospitals, and are abundantly provided with warlike stores.  
 "They are connected with one another and with the interior by railways.  
 "They can communicate readily with the field army wherever it may be. They  
 "are situated in fairly prosperous and flourishing districts. All are on good  
 "lines of defence, and, except Breslau, well fortified. The base of operations  
 "against Russian Poland, and subsequently against Russia, would thus possess  
 "all conditions desirable, whether from the military or from the administra-  
 "tive point of view, if its flanks were only secure. The left flank, indeed,  
 "rests upon the Baltic, and may be looked upon as safe, but not so the right



"flank. The German base is seriously menaced, both in flank and rear, on the side of Bohemia and of Silesia; indeed, the fate of all Prussian Silesia seems to depend upon the issue of a single battle. Therefore, in a war against Russia, Germany has the greatest possible interest, from the military point of view, in having Austria for an ally, or at least in being quite sure of her neutrality.

"In choosing his line of operations, the German Commander-in-Chief will be guided by three special considerations; first, that he will be able to bring his force into action more quickly than the enemy, in consequence, if for no other reason, of the more complete development of the German railway system;<sup>1</sup> secondly, that the German base envelops the Polish theatre of war; lastly, that Russian Poland has but little cohesion with the rest of the Empire in consequence of the marshes of Pinsk.

"The (probably) more speedy strategical deployment of the German Army will give it the opportunity of surprising the Russian forces already stationed in the basin of the Vistula, and of cutting them up in detail.<sup>2</sup>

"The overlapping form of the German base will make any line of operations, having for its objective Russian Poland, strategically safe, and will give the Commander-in-Chief considerable facilities, should he wish to change that line.

"The want of cohesion between Poland and the remainder of the Russian Empire will naturally suggest to the German General the idea of slipping in between the two, of completely isolating the regions of the Vistula, of overwhelming its garrison, and of preventing the arrival of reinforcements from the interior.

"Whether the main German operation should be directed from Posen-Thorn against the triangle Warsaw, Novo-Georgiewsk, Sierask, or from Königsberg-Boyen against Brest-Litowski, whether to play a safe or a bold game, whether to aim at the Russian Army or at its communications, he who has to decide this question must go beyond mere geographical considerations; he must take account of a great mass of circumstances, and above all he must reckon up the armed force which Germany can hurl on Russia.

"We should exceed our limits if we attempted to combine these different elements.

"Our rapid survey satisfies us that the north-eastern frontier of Germany forms an excellent base both for offence and defence. The strategist will find in it almost an ideal theatre of war, a field for numerous and varied combinations."

We will conclude this paper by quoting the last paragraph of the pamphlet by "ein deutscher Offizier":—

<sup>1</sup> The undoubted superiority which Germany enjoys over Russia, both in regard to speed in mobilization (owing to better organization) and to speed in concentration (owing to a more complete railway system), may be counterbalanced, or even more than counterbalanced, by the manner in which the forces of the two Powers are distributed in peace time. In Germany each corps occupies its own district. In the frontier provinces (East and West Prussia, Posen, Silesia, and Pomerania), there are four army corps, consisting altogether of 100 battalions, 22 regiments of cavalry, 68 batteries of artillery = 272 guns, and 4 pioneer battalions. All these corps are on the peace footing. In the Russian frontier provinces directly bordering on Germany, *i.e.*, in the military districts of Wilna and Warsaw, there are at this moment (as we learn from Hauptmann v. Tröltzsch's "Dislocations Karte der Russischen Armée," which was lately laid before the German Parliament), 252 battalions of infantry, 30 regiments of cavalry, 80 field batteries with 320 guns, 13 horse artillery batteries with 78 guns, and 11 battalions of engineers. The cavalry and horse artillery are nearly if not completely on a war footing.—L. G.

<sup>2</sup> See previous note.

"If the Emperor Alexander after this meeting" (that with the Emperor of Germany in 1879) "made use of the words attributed to him, 'Thank God, a war with Germany is impossible,' he certainly expressed the feelings of the great majority of his loyal subjects, and those words will not be wiped out either by Nihilist or Panslavist agitators, nor by certain discontented statesmen and Generals, who after sharing many a disillusion during the late Russo-Turkish War, may wish to satisfy their ardent thirst for glory at the expense of Germany, but who might possibly find out by experience that it is more difficult to gain their object in a war against that Power than even in one against Turkey."

LUMLEY GRAHAM.

*The German Frontier Provinces.**Distances by Railway.*

	Eng. miles.		Eng. miles.
Berlin to Stettin .....	83		
Stargard .....	105	Branch to Posen .....	105
Belgard .....	173	Branch to Colberg .....	22
		Posen .....	140
Stolp .....	230		
Danzig .....	311	Branch to Protsken (Russian frontier) .....	120
Königsberg .....	370		
Berlin to Küstrin .....	50	Branch to Stettin .....	60
		Glogau .....	95
Kreuz .....	116	Branch to Posen .....	50
Schneidemühl .....	152	Posen .....	60
Dirschau .....	264		
Marienburg .....	275	Ilowo (Russian frontier) .....	90
Königsberg .....	365		
Insterburg .....	420	Memel .....	90
Eydtkühnen (Russian frontier, for St. Petersburg) .....	461		
Berlin to Schneidemühl .....	152		
Bromberg .....	197		
Thorn .....	237		
Berlin to Frankfurt .....	50	Branch to Küstrin .....	20
Posen .....	110	Branch to Glogau .....	70
		Breslau .....	100
Gnesen .....	140		
Thorn .....	195		

	Eng. miles.		Eng. miles.
Berlin to Thorn .....	195		
D. Eylau.....	255	Branch to Ilowo (Russian frontier) .....	45
		Marienburg.....	40
Korschen .....	340	Branch to Königsberg.....	50
		Protken (Russian frontier) .....	70
Insterburg .....	385		
Eydtkühnen.....	410		
Berlin to Frankfurt .....	50		
Glogau .....	140	Branch to Wilhelmsbrück .....	55
Breslau .....	200		
Berlin to Frankfurt .....	50		
Guben.....	80		
Sagan .....	120		
Liegnitz .....	165		
Breslau .....	208		
Berlin to Cottbus .....	70		
Horka .....	115		
Liegnitz .....	170		
Breslau .....	213		
Breslau to Oppeln.....	50	Branch to Dossowska .....	20
Mysłowitz (frontier of Poland and Galicia)	95		
Dantzic to Dirschau .....	20	Branch to Marienburg (crossing the Vistula).....	10
Laskowitz .....	75	Branch to Graudenz (crossing the Vistula) .....	14
		Jablonowo .....	30
Bromberg .....	105	Branch to Inowracław .....	29
Thorn .....	145	Branch to Alexandrowo (for Warsaw).....	10
Inowracław.....	166	Branch to Bromberg .....	29
Gnesen .....	201	Branch to Posen .....	30
Jaroczin .....	241	Branch to Posen .....	41
		Oels.....	56
		Breslau.....	76
Kempen .....	297	Branch to Wilhelmsbrück (frontier).....	6
		Breslau .....	49

	Eng. miles.		Eng. miles.
Dantzic to Dossowska .....	346	Branch to Oppeln .....	20
Schoppinitz .....	381	Junction with railway from War- saw (Russian).	
Myslowitz .....	384		
Oswiecim .....	399	Junction with railway from Cra- cow (Austrian).	

N. B.—We have only attempted to show the distances between the principal places on the main lines leading from the capital to the frontier, and on the most important connecting lines and branches. The number of the latter is very great, especially in Upper Silesia.

For more complete information about the German railway system our readers are referred to Ottersky's excellent map of "Mittel-Europa," in four sheets, and to Hendschel's "Telegraph."

*The Russian Frontier Provinces.*

*Distances by Railway.*

	Eng. miles.		Eng. miles.
St. Petersburg to Dünaaburg .....	298	Branch to Riga .....	120
		Smolensk .....	220
Wilna .....	394	Branch to Libau .....	192
		Wirballen (east Prus- sian frontier) .....	106
		Minsk .....	105
Bialystok .....	528	Branch to Prostken (east Prussian frontier) .....	43
		Brest-Litowski .....	90
Warsaw .....	627	Branch to Mlawa (east Prussian frontier) .....	66
		Ivangorod .....	57
		Kowel .....	189
Moscow to Smolensk .....	237	Branch to Dünaaburg .....	220
		Orel .....	218
Minsk .....	423	Branch to Wilna .....	105
		Bobruisk .....	87
Brest-Litowski .....	615	Branch to Bialystok .....	90
		Kowel .....	72
		Kiew .....	365
Warsaw .....	735	Branch to Kiew (viâ Kowel) ...	486

	Eng. miles.		Eng. miles.
Warsaw to Alexandrowo (near Thorn).....	129		
Warsaw to Czentochau.....	129		
Schoppinitz (Silesian frontier) .....	174		
Warsaw to Granica (viâ Czentochau Galician frontier)	174		
Warsaw to Koluszki (on Czentochau line) .....	60		
Lodz .....	76		
Kalisch .....	136	} Projected lines viâ Lodz.	
Wilhelmsbrück .....	136		
Warsaw to Slupce (viâ Kutno and Konin, projected) ..	135		
Sandomirz to Koluszki (projected)	95		

N.B.—Our readers are referred for further information about Russian railways to Hendschel's "Telegraph," to the map of "Das Europäische Russland," published by the Geographisches Institut at Weimar, and to Ottersky's map of "Mittel-Europa," published at Wesel.

## THE TRAINING AND OFFICERING OF RESERVES IN FOREIGN ARMIES.

By Captain H. HILDYARD, 71st Highlanders.

(Continued from No. CIII.)

### THE RUSSIAN ARMY.

A FORMER paper treating of the Reserves of the principal European armies was limited to a consideration of their training, and the manner in which they were officered. In the present one, which will be devoted to the Russian Army, it is proposed to pass beyond these limits, an endeavour being made to investigate the several ordinances which at the present time regulate service in this force and its Reserves, and to record the results that have been obtained by them. The principle of universal liability to military service was proclaimed as early as 1870, but it was only four years later that practical effect was given to it by an entire reconstitution of the Army. Before, however, any extensive results could be obtained from the new system, Russia found herself involved in a war which tested all her resources, and afforded an opportunity of seeing in what points her military system was especially defective. This has been taken advantage of, and regulations promulgated in August, 1878, provide for such changes as have been deemed necessary, being

directed chiefly to the consolidation of the reserve forces. The principal provisions, however, of the Law of 1874 still remain in force ; and, as it is upon them that all subsequent regulations are based, it is necessary to commence by a brief consideration of these. By the law referred to, every male in European Russia became liable to military service upon completing his 20th year, and continued to be so until the commencement of his 40th year ; but certain exemptions were made on account of physical disabilities, and for family or professional reasons, most of which were of a temporary or provisional nature only. The forces of the Empire being divided into a standing army composed of an active portion, of a reserve, and a so-called general militia, the nineteen years' service to be rendered were apportioned between these in the proportion of six years with the colours, nine with the reserve, and four with the militia. As, however, the normal strength of the standing army was only 780,000 men, whereas the number annually attaining the legal age was about 650,000, it was impossible to draft more than a small proportion of these into it, which was done by lot, those not taken being borne during the period of their liability on the lists of the militia, where they received no drill or instruction. This militia was divided into two categories or bans, to the first of which belonged the four youngest classes of militiamen, while the rest formed the second ban. Of these, the former was not only intended to provide a force for home defence, but also to reinforce the active army, or fill vacancies in it should the regular reserve prove insufficient for the purpose ; and it could be called out by the simple process of an Imperial order directed to the Senate. The second ban, on the contrary, was intended exclusively for home defence, and a special Imperial decree was necessary to call it out, which was only to be resorted to in extremely exceptional cases.

By the arrangements thus adopted, a period of fifteen years must have elapsed before the formation of the army reserve could be completed, whilst four more must pass before all the advantages contemplated could be attained. As, however, it was considered a matter of great importance to hasten their attainment as far as possible, the term of service with the colours was from the outset reduced to five years, and subsequently to four, a proportionate increase being made in the annual contingent. Thus, from a service of six years, and a contingent of 150,000 men in 1874, the latter rose to 180,000 in 1875, and 196,000 in the following year. The organization introduced with a view to providing cadres for formations to be completed upon mobilization by the large number of reserve men who would eventually be available, was very elaborate. Apart from the regular army, which would be raised to a war strength by the reserve men, assisted if necessary by the militiamen of the first ban, an extensive territorial system was inaugurated in each of the fourteen military regions. This comprised the following four heads, to which must be added a fifth subsequently formed by the militia, in accordance with regulations issued in 1876. These were classified as local troops, garrison troops, dépôt troops, and reserve troops, and are all under the special direction of a regional Commander of territorial troops. This Officer is entrusted with the whole of the interior military services, and the command of all troops in the second line, having the powers of a *Corps d'Armée* commander under the Officer Commanding-in-Chief of the district, to whom he furnishes a detailed annual report. An executive military commandant under his orders is responsible for the details of recruiting, and for the proper execution of the regulations regarding the reserves, of which he has to render periodical numerical returns. In case of mobilization, it is this Officer who is responsible for placing promptly a portion of the territorial forces, comprising the local and fortress troops, on a war strength ; and for the formation of dépôt and reserve battalions. Beneath him again comes the District Military Commandant, who has under his immediate command the local troops of the district to which he holds the position of an Officer commanding a corps.

The first category of the territorial formations comprises the local troops, the object of which was to provide for the service of the interior in their respective localities in peace time, while in time of war they were intended to relieve the active army entirely from all home duties, so as to allow of the whole of it taking the field. They were also largely called upon to contribute to the formation of *dépôt* and reserve battalions, having in addition the entire charge at all times of the stores required to equip the *dépôt* troops, and in war of those also left behind by the active battalions on taking the field. Under normal conditions, the local troops are recruited, in the same manner as the rest of the Army, from the annual contingents, in time of war they are completed by reserve men, and in case of these being insufficient in number, by the militia of the first ban.

They were organized by battalions and by detachments forming separate corps, the strength of which varied according to local circumstances. A portion of these bodies had a permanent fixed effective, being stationed in localities where there were no active battalions, and where consequently the duties were the same at all times. The remainder were organized on a reduced establishment, which was in time of war to be increased, the battalions and detachments being expanded into regiments and battalions respectively by the means already referred to. Of the permanent formations there were in European Russia 10 battalions and 468 detachments, and in the Caucasus, 2 battalions and 47 detachments, whilst in Asiatic Russia there were analogous formations all on a permanent effective. The variable formations numbered in Europe 8 battalions and 35 detachments, and in the Caucasus 1 and 12. The total effectives of the local troops on a peace and war establishment by the organization of 1874, reached the following numbers :—

	Peace.		War.	
	Officers.	Men.	Officers.	Men.
Europe .....	717	56,062	1,513	107,264
Caucasus.....	246	16,121	571	31,241
Asia, including Eastern and Western Siberia and Turkestan.....	316	16,920	316	16,920
Total.....	1,279	89,103	2,400	155,425

The next category to be considered is that of *fortress troops*, instituted with a view to providing permanent garrisons for fortified places, and assisting the garrison artillery. In time of war they were to perform the entire garrison duty, besides assisting the artillery in the service of the guns, and the engineers in the works to be executed. The strength of this force was fixed accordingly at a war effective sufficient to provide for these services, and thus free the active army from all garrison duties. As, however, it was foreseen that circumstances might arise in time of war, which would allow of the withdrawal of a portion of the garrison troops for the reinforcement of the army in the field, or for service on the lines of communication, the organization of the fortress troops was assimilated to that of the rest of the Army. The number of battalions was fixed in time of peace at 29, though the formation of 24 only was effected. These were recruited, in the same manner as the line battalions, from the annual contingents, being completed on mobilization



by reserve men, when each battalion was to be expanded into a regiment of four battalions. The total strength of the fortress troops was as follows :—

Peace.		War.	
Officers.	Men.	Officers.	Men.
841	14,935	2,465	120,002

In these numbers is not included the garrison artillery, of which 50 battalions of 4 companies each were to be formed, though in April, 1876, only 20 were in existence. The total effective of this force is in peace time 20,000 men, which is in time of war raised to 60,000.

The *dépôt* troops are only called into existence upon mobilization, when battalions are formed in the proportion of one per infantry regiment of the line, numbering in all 164. By an ordinance dated 1876, however, the same principle is extended to the Guards, Grenadiers, and Chasseurs, though the rules regarding them differ considerably. These raise the total number of battalions to 199, which are constituted in the following manner on mobilization. The total strength of each battalion is 1,356 of all ranks, including non-combatants, which fall under the two heads of *permanent effectives* and *variable effectives*. Of the former there are 13 Officers, and 114 non-commissioned officers and men, who are employed in the administration of the battalion, and in the instruction and training of the men borne under the head of *variable effectives*. They are drawn from the active or local troops nearest to the centre of formation, the proportion of Officers to be provided by each active regiment being at least six. The commander of the battalion is appointed by selection from the general list, while the 2nd, 4th, and 6th senior Captains and Lieutenants are taken, the remainder of the Officers being generally taken from those on the reserve list serving with the local troops. Besides 2 Officers, there are 10 non-commissioned officers drawn from the reserve, and 16 lance-corporals, per company, more especially intended to drill the men of the *variable effectives*, and prepare them for drafting to the front to fill vacancies. The normal strength of the latter is, not including non-combatants, 44 Officers, 32 volunteers, and 1,016 non-commissioned officers and men, the whole of whom are drawn from the reserve. In time of peace, states of the formation are left prepared, with nominal rolls of Officers, so that no delay may arise in their formation in case of mobilization. With the same end in view, places have been selected as the centres of formation for the several battalions in the localities from which their men are drawn, and the transport, ambulance equipment, &c., are there permanently stored in charge of the local troops. In addition to this, separate points of assembly are fixed for each of the four companies composing the battalion, at which the arms, clothing, and equipment of the company is stored. On mobilization, therefore, there should be no unnecessary delay; the permanent effectives called up in the first instance are distributed to companies on arrival by the military commandant of the battalion district. They then proceed to their company rendezvous, ready to receive the reserve men destined to form the variable contingent on arrival. These are clothed and equipped as rapidly as possible, and are then directed to the battalion centre of formation, where their training is completed without delay. They are then drafted by detachments composed of a proportion of all ranks, to complete establishments in the active army, their place at the *dépôt* being filled at once by calling up more

reserve or militiamen. The dépôt battalions of the line are not attached especially to active regiments, but they are grouped by fours, each of which corresponds by its locality and uniform to one of the four regiments of an infantry division, each of which has a distinctive colour throughout the Army. These have consequently the character of *divisional dépôts*, whereas those of the Guards, the Grenadiers, and the Chasseurs are strictly *regimental*, the reserve Officers and men called up being drafted, as far as possible, to the corps in which they have previously served.

Of the 14 military regions into which the whole Empire is divided, 7 are unprovided with this dépôt organization, viz., Finland, Warsaw, the Caucasus, East and West Siberia, Orenburg, and Turkestan. In Finland, the military organization has hitherto been special, although by a recent enactment obligatory service will be introduced in the course of the present year, and the terms of service assimilated to those in the regular Russian Army. It is possible that this may induce also a parallel organization; but up to the present this is not the case, and there is no formation of dépôt troops in Finland. Their absence from the Warsaw circumscription is accounted for by the fact that the contingent from this frontier province is distributed throughout the entire Russian Army in a proportion not exceeding 25 per cent. in any one regiment. The other five circumscriptions have been exempted on account of the small number of the inhabitants and their mixed origin, and also because of the paucity of roads and the difficulty of communication. In the seven circumscriptions in which dépôts have been established, the number of these varies according to the proportion of the contingent furnished by them, and consequently in proportion to the number of their inhabitants. Thus the Moscow district, with its seven and a half millions of male inhabitants, has 49 dépôt battalions, whereas that of St. Petersburg, which numbers less than two million inhabitants, has only 8.

Besides these dépôt battalions, there are in Russia other military forces included under the denomination of dépôt troops, but their organization is different, and they are for the most part in existence in time of peace. These are dépôt squadrons of cavalry, battalions of sappers, and brigades of artillery. The squadrons which are grouped in seven brigades formed of one squadron per regiment are utilized in time of peace for training remounts, whilst in war time detached squadrons are formed and despatched to the front to fill up vacancies occurring. The dépôt squadron of the Guard and of the Caucasus Dragoons remain in peace time with their head-quarters.

There are no dépôt formations for the sappers in peace time, but on mobilization, five of the battalions detach each one company to form a nucleus for the formation of a dépôt battalion of four companies. For the artillery 4 dépôt brigades are in existence in peace time, from which 48 dépôt batteries are formed irrespective of 48 reserve batteries.

With a view to admit of a greater development of the military forces in Russia, the Law of 1874, introducing obligatory service, reduced the period to be passed with the colours, and increased proportionately the strength of the annual contingents. The former was fixed at six years, and the latter at 150,000 men, but from the first application of the law, a still further reduction was made in the period of service, whilst the contingent was proportionately increased, as already pointed out. It was evident, therefore, that within a few years such a number of reserve men would be available, who had passed the prescribed period with the colours, as to complete the active establishments upon mobilization, as well as the local, fortress and dépôt formations, and still leave a large body of men to be disposed of. The term of service reduced to five years would, it was calculated, undergo in course of time a still further reduction to four years. This being the case, it was estimated that when the law should have attained its extreme development, after completing the active, local, and fortress establishments, 466,000 men

would remain available, of which 260,000 would be required for the formation of depôt battalions, leaving a residue of 206,000 men. To provide for the utilization of these upon mobilization, it was decided to form from them reserve battalions, which, without having any existence in time of peace, even in a cadre formation, should be provided for beforehand in such a manner as to ensure their prompt creation. By the fundamental law, the number of battalions to be so created was to be regulated by the numbers of men available, which, if as estimated above, would have given 192 battalions of 1,072 men. But for convenience, it was decided to fix the number of reserve battalions at 164, corresponding to that of active battalions, and the equipment for these was to be maintained complete in stores under the charge of the local troops stationed in the various districts. To form the cadres on mobilization, a certain number of Officers and men serving in the active and local troops nominated beforehand, were to be drafted to the reserve battalions, proceeding to the points of assembly, ready to receive, arm, equip, and form the reserve men as they came in. The organization of the battalions was to be the same as those of the active army, and they were to be formed under the supervision of the commander of the territorial troops of the circumscription, continuing under his orders so long as they remained at their stations of formation. Primarily, they were to remain in independent battalions, but they, or a part of them, might subsequently be collected as requirements might dictate, into brigades and divisions. This want of uniformity in the formation was rendered necessary by the variety of uses to which it was proposed to put the reserve forces. In the first place, they might be required to perform detached local duties in the town, or to strengthen the garrisons of the fortresses, they might also be employed as *etappen* troops on the lines of communication, or for the occupation of the country in rear of the theatre of operations, and they might have to reinforce, or lastly, take the place of active troops in the first line. For most of these employments no further organization would be required than that of the battalion, whereas, in the two last, it would be indispensable to form brigades and divisions before active operations in the field could be undertaken.

In addition to these reserve battalions of infantry there was one of the Guard, which was to be maintained permanently in time of peace and raised to a regiment upon mobilization. There were besides 48 batteries of field artillery to be formed in time of war for the purpose of operating with the infantry. As already pointed out, 20 companies of sappers were also to be formed from 10 companies detached from the active battalions.

A sketch has now been given of the several categories of the territorial and reserve formations as introduced into Russia by the Law of 1874. These have been considerably modified by measures introduced in 1878 based upon the experiences of the war, then not long concluded, and which affected more particularly the local and reserve formations. Before entering upon these and analyzing in detail the actual position of the Russian Army, it will not be without interest to touch upon the actual experiences of the mobilization effected during the war referred to. It was only in 1874 that the law was promulgated by which the term of service was reduced to six years, and the reserves required were provided for, by increasing the annual contingent to 150,000 men. The term of service with the reserve being fixed at nine years, to obtain the maximum effects contemplated a period of no less than fifteen years was required; and although the term of service with the colours was from the outset reduced to five years, and subsequently to four, no material results could be expected from it, in 1876, after a lapse of less than two years, when the first partial mobilization was effected. As a matter of fact the number of reserve men was then much too small to meet the numerous requirements; the field forces had been only slightly strengthened, whilst the organization of the fortress and depôt troops was but half completed, and the

reserve formations not commenced. In consequence of this it became necessary from the outset to institute special measures, and to borrow on a large scale from the permanent troops not required to take the field, in order to complete those to be mobilized. The energy of the War Department, and the unlimited resources in money placed at its disposal, alone allowed of the huge forces which subsequently took the field being organized and equipped, and of these a very large proportion had received but an incomplete training and a portion none at all. At the commencement of 1876 the standing army on its normal peace footing consisted of 25,716 Officers and 774,605 men, not including the irregular force of Cossacks, numbering about 1,972 Officers and 55,083 men.

On the 1st November of that year the first mobilization was ordered, including all the troops stationed in the military regions of Kiel, Odessa, Kharkoff, and a portion of the corps belonging to those of Moscow, Vilna, and the Caucasus. These comprised 20 divisions of infantry, 8 of cavalry with their artillery, 3 brigades of chasseurs, and 2 of sappers; 4 fortress regiments, the fortress artillery of 5 fortified places; 3 regiments, 26 battalions, and 150 detachments of local troops; 85 battalions, 22 squadrons, and 16 batteries of dépôt troops; and the corresponding administrative and auxiliary services.

From the mobilized troops 6 corps d'armée were formed, 224,312 reserve men being recalled to the colours to complete the formations, whilst 33,166 Cossacks were called up from the Don and the Caucasus districts.

The remainder of the Army, about 630,000 men, had not been mobilized and remained quartered as before.

During 1877, when war was declared, the following troops were successively brought up to a war footing, viz., 16 divisions of infantry, with their artillery parks and divisional hospitals; the brigade of Chasseurs of the Guard; 4 divisions of cavalry with their horse artillery batteries and parks; and 2 brigades of sappers. Of dépôt troops corresponding to the above—64 battalions of infantry, 1 of chasseurs, 48 squadrons, 15 batteries, and 2 battalions of sappers. Of territorial troops—3 fortress regiments, 3 battalions of garrison artillery, 2 local regiments, 45 battalions, and 11 detachments. For the purpose of protecting the communications and for service generally in rear of the Army—52 reserve battalions, with 12 batteries of reserve artillery, were formed into 4 infantry divisions of reserve. The Cossack formations were also largely increased, the Don Cossacks by 8 squadrons, 60 sotnias, and 48 guns; those of Orenburg and Astrakan by 2 regiments each, and those of the Kouban and Terek by 33 regiments, 7 divisions (2 squadrons), and 28 sotnias; whilst the local militia of the Caucasus furnished 13 droujinas and 5 battalions. The result of these measures was, that at the close of 1877, the regular troops numbered 36,871 Officers and 1,478,495 men, whilst the irregulars included 3,167 Officers and 120,362 men. Of these large numbers no less than 740,000 men were included in the armies operating against Turkey and in the troops destined for the defence of the shores of the Black Sea, a number surpassing any previous effort made by Russia. In 1812 her armies numbered 615,000 men, of which 270,000 were militia; in 1828 the armies of the Danube and of Asia Minor did not exceed 229,000; in 1831, the men concentrated in Poland and the Western Provinces were about 137,000; whilst in 1855 the armies of Southern Russia, of Turkey in Asia, and the troops destined for the protection of the Baltic and Black Sea shores, amounted to 669,000. In 1878, however, the large forces already mobilized were destined to be still further extended, notwithstanding that the second period of the campaign, which closed with the Treaty of San Stefano, had completely subdued the military forces of Turkey. It was at this time that new political complications necessitated the maintenance of the Russian Army in a state of preparation for any eventuality, and extraordinary efforts were made to prepare materials for the formation of armies on her western frontiers. But

little assistance towards this could be derived from the armies in Turkey and Asia Minor, or from the troops of the Odessa region, and the greater portion of those men required had to be drawn from the troops stationed in the interior. These consisted of 12 divisions of infantry, 3 brigades of chasseurs, 1 brigade of sappers, 6 divisions of cavalry with artillery, of the regular army, which had not hitherto been mobilized, and which could be promptly brought up to a war strength by means of the reserve men attached to them, who had been carefully kept intact. It was, therefore, determined to resort to this mobilization only as a last resource, while in the meantime the formation of fresh reserve forces, which was necessarily a lengthy task, was pushed on with energy. The results attained were the formation of 14 reserve divisions of infantry, the cadres for which were drawn from the garrison and local troops; 14 brigades of artillery; the transformation of the garrison regiments of Cronstadt and Sweaborg into complete garrison divisions; the creation of 8 reserve battalions in Turkestan; the augmentation of the Caucasus troops by 39 garrison and local battalions; the development of the local troops in Russia; and the calling up of 10 Don Cossack regiments, 7 Orenburg Cossack regiments, and the formation in the Caucasus of 7 irregular cavalry regiments and 4 droujinas of provisional militia. The result of these supplementary measures was to raise the total effectives of the regular troops to a strength of 39,268 Officers and 1,647,795 men, and that of the irregulars to 3,672 Officers and 140,882 men; giving a grand total little short of 2,000,000 of men. This was the strength of the forces under arms on the 1st July, 1878, when the decisions of the Berlin Congress led Russia to discontinue her warlike preparations. In the following table the normal peace establishment and the results attained by successive mobilizations on the dates already given are summarised, the numbers being exclusive of Officers; and it will be seen by comparison that the utmost development reached brought the forces up to more than double of what they were on the peace establishment. This was exclusive of the considerable number of men forwarded in detachments to the front to complete establishments, which in 1877 was 92,748, and during the whole course of the campaign and before Constantinople was no less than 175,000 men, most of whom were recruits of the contingent of 1876, the remainder being militia called up in 1877 and men discharged from the hospitals.

Nature of troops.	13th January, 1876.	13th January, 1877.	13th January, 1878.	13th July, 1878.
Regulars .....	774,605	1,071,601	1,478,495	1,647,795
Irregulars .....	51,489	87,765	120,362	140,882
Total .....	826,094	1,159,366	1,598,857	1,788,677

These numbers are exclusive of Officers.

But though the enormous number of 2,000,000 of men, including Officers and men, had been under arms between the period embraced by the war, the resources of Russia, in men, was far from exhausted at its conclusion. The portion of the regular Army not mobilized would, it is asserted, when completed by reserve men, who are alleged to have been available, have increased the Army by over 200,000 men. But besides this source, the cadres of the fortress and local troops allowed of further extensive formations by the incorporation of the militiamen of the 1st ban, of whom not more than about an eighth part were called up in 1877. In addition to these the Cossack troops admitted of considerable expansion, and as a last resource the

general militia of the 2nd ban remained untouched. It may indeed be said that the actual material for the formation of the rank and file was inexhaustible, but, as will be seen presently, the cadres for the embodiment of these not only were non-existent, but could not be obtained. In fact it was only by the greatest exertions that cadres could be provided for the formations actually in existence, and when obtained they proved to be far from efficient, while in order to obtain, them resort was had to the cadres throughout the entire Army, which were themselves considerably weakened by the process.

Already under the old *régime*, before the system of enormous reserves since introduced had been so much as contemplated, the supply of Officers for the ordinary establishments had been found a difficult problem in Russia. Prior to the Crimean War the corps of Officers was recruited almost exclusively from the nobility, but the exigencies of this war necessitated the adoption of special measures by virtue of which an altogether different class of men was admitted. The war at an end, means were taken to remove those who had entered under these special circumstances, whilst on the other hand a great number of excellent Officers left the Army on their own initiative for the purpose of embracing more lucrative civil careers, offered by the development of the economic productions of the country. To fill the numerous vacancies which occurred, recourse was had to the extension of Younker Schools, but even this means and the action of the one-year volunteer system, introduced with obligatory service, failed to supply sufficient Officers, whilst the standard both of their social qualifications, and of their military efficiency, suffered a considerable diminution. Thus in 1877, at the moment when not only was it necessary for the ordinary formations to be fully officered, but fresh ones had to be originated in great numbers, there were 133 vacancies out of a total of 495 appointments on the General Staff. This is the more noticeable, because in Russia the privileges and advantages granted to Officers on the Staff make these appointments much sought after. In the line, even supposing the establishments to be complete in time of peace, there could not fail to be a great want of Officers upon mobilization, unless a considerable reserve was in existence, which was not the case. The difference of the establishments alone between a peace and a war footing was sixteen Officers per regiment, whilst six more had to be detached to form a part of the cadres of *depôt* battalions, and beyond these there were a number required for staff and administrative duties, and to assist in the mobilization of local, and the formation of reserve troops. A quantity of retired Officers were recalled to the colours, but their number was insignificant comparatively, and notwithstanding this, the numbers which had to be withdrawn from their regiments were so great as to produce in many cases a complete change in the constitution of the corps concerned. Thus in the first sixteen divisions mobilized, the number of vacancies to be filled was no less than an average of 132 per division, while the whole of the vacancies requiring to be filled at short notice was 5,822. The promotions for this purpose were made regimentally up to the rank of Captain inclusive, while those to Major were made throughout the division. The wholesale promotions sufficed, with the help of a certain number of Officers recalled to service, to complete the higher grades, but notwithstanding the extensive promotion of "younkers" to the rank of Ensign, and the dispensation from examination granted to candidates, by an order of the 9th October, 1877, the numbers required to maintain this rank up to its establishment in the field could not be obtained.

The disadvantages of such a state of affairs as is here described can hardly be overrated, and they were fully evidenced in the course of the campaigns of 1877-78. As has been already pointed out, the war came upon Russia while her Army was in a state of transition and before the reorganization aimed at by the Law of 1874 could produce any considerable effect. Notwithstanding



this no difficulty was experienced in producing as many men as were required, while an enormous reserve of untrained material was still available. With a more complete organization, and an abundance of well-trained Officers, this material could have been rapidly made available for the service for which it was required, but these were not forthcoming. Consequently untrained or partially trained men were drafted to corps, the Officers of which were themselves in great part new to their work, and who were mostly unfitted for anything beyond the daily routine duties. Happily, perhaps, for Russia, the conquest of Turkey was not achieved without difficulty, and the opposition experienced, while calling forth an energy of which Russia was justly proud, brought home to her also the insufficiency of military arrangements as provided for by the Law of 1874.

The necessity of her organizing the reserve troops as an army of 2nd line, and of having this ready to take the field early in a campaign, was the main point brought forward, and this has been the basis of the new organization adopted shortly after the conclusion of the late war, effect to which was given by the Law of the 27th August, 1878; the principal provisions of this are as follows:—The infantry garrison troops, as well as the greater portion of the battalions and detachments of local troops were suppressed, both their *personnel* and *matériel* contributing towards the formation of reserve battalions. From the four reserve divisions employed during the campaign, permanent reserve battalions were to be formed on cadre establishment. Estimates and tables were ordered to be drawn up in the offices of the Ministry of War, of the *matériel* and arms required upon mobilization by regiments and battalions of reserve, by the staff formations of divisions and brigades, and by the divisional field hospitals.

Besides these general provisions, a special order was issued at the same time regarding the infantry reserve formations. The object of these was stated to be to reinforce the active troops, to garrison fortresses and other fortified points, and to perform local service in the interior. In war time the necessary cadres for the formation of *dépôt* battalions was to be drawn from them. In peace time the infantry of reserve is to comprise the reserve battalions, on a cadre formation, of the Guard and of the line, of which the former are to be completed on mobilization to as many Guard reserve regiments, while the latter are to form line reserve regiments and independent reserve battalions. Each battalion on a cadre formation consists of five companies, which will be expanded on mobilization, by means of reserve men called up into so many battalions. Of these, the first four are to be combined to make a regiment, these again being formed into brigades and divisions. The fifth battalions formed in this manner are retained as separate corps to be stationed at the local centres of formation and employed in garrisoning fortified places and important towns. In case of necessity, however, these may be replaced by detachments of militia, and they may equally be formed into regiments, brigades, and divisions for employment in the field. The number of reserve battalions on a peace footing is one for the Guard and 96 for the line, forming in time of war 24 reserve divisions of 4 regiments composed of 4 battalions, and 101 independent battalions, or in all 485 battalions.

The permanent battalions on a cadre formation are quartered in time of peace in fixed places, in fortresses, and in other large towns, and a staff for purposes of instruction and drill is attached to each. A special *dépôt* is set apart at each of these centres, in which is stored the whole of the intendance *matériel*, as well as that of the artillery, and also the ambulances for the regiments and corps. This is to be kept strictly intact and maintained in a thoroughly serviceable condition, so as to ensure these troops being able to take the field without delay and fully equipped whenever their services may be required.



In time of peace the battalions are recruited in the same manner as the remainder of the Army by means of men taken from the annual contingents, and it is only on mobilization that reserve men are called up to complete and expand the original cadre formations. Should these prove insufficient for the requirements, recourse may be had to the militia of the first ban, which after 1883 will comprise four classes of men who have passed through the regular Army and its reserve. The casualties occurring during the course of a campaign, by losses before the enemy or by sickness, are to be filled up in the same manner as battalions of the active divisions by means of men trained at the *dépôt* battalions, and drafted to the front. As has already been noted, the number of reserve battalions to be maintained in peace time is 97, which in time of war will be expanded into no less than 485, including the 101 independent battalions. The establishment of these on the normal cadre formation is 3,304 Officers, and about 60,000 of other ranks including non-combatants, whilst after mobilization it is 9,801 Officers and 504,000 of other ranks. These former were obtained in the first place partly from the reserve divisions formed during the last war, and which served as a basis for the new formations, and partly from the local and fortress troops which were reduced.

The *raison d'être* of the former of these, as organized by the Law of 1874 for local duties, ceased to exist, so far at least as European Russia was concerned. The 18 battalions, therefore, and 35 variable detachments stationed there were reduced, their places being taken by reserve battalions in the chief towns and seats of Government, where no regular troops were stationed. The Caucasus has not been affected by the change and has still local detachments, amounting in peace time to 16,360 of all ranks, and about double that strength in time of war, while in Asia, including Eastern and Western Siberia and Turkestan, these troops remain on a permanent establishment of about 17,000. The reduction, therefore, of the local troops is limited to Europe, and the number so reduced to 717 Officers and 56,062 of other ranks in peace time, which were in time of war capable of expansion to 1,513 Officers and 107,264 non-commissioned officers and men.

The battalions of fortress infantry have been altogether swept away and merged into the new formations, giving a further diminution in peace time of 841 Officers and 14,935 men, and of 2,465 Officers and 120,000 men when completed and expanded on mobilization.

If the two be taken together it will be found that in peace time the Officers set at liberty for employment with the reserve battalions are 1,558, whereas 3,304 are required for these latter formations, or rather more than double this number, which has presumably been completed by Officers from the reserve divisions mobilized during the war. Of other ranks nearly 72,000 have been rendered available by the reduction of the local and fortress troops, as against the 60,000 borne permanently with the reserve battalions, leaving a surplus of some 12,000 over the actual requirements. After completion and expansion upon mobilization, however, the proportions between the old and the new formations show out much more strongly, for in place of 3,978 Officers and 227,000, about, of other ranks, provision is made for 9,801, or nearly treble the number of Officers, and for 504,000, or about double the number of other ranks. If we examine, with a little care, the changes thus made, the first thing which must strike us is the increased proportion of the Officers to the men in the permanent cadres, which is very considerable, the number of the former having been doubled, whereas that of the latter has actually suffered a diminution. This is a most important point, and must contribute immensely to the efficiency of the reserve formations themselves, whilst avoiding the wholesale withdrawal of Officers from active battalions on mobilization. By itself, however, the number of Officers permanently borne is altogether insufficient to supply more than the barest cadres for the

new formations, to complete which no less than 6,497 would be required in addition. These, however, are to be provided for beforehand and inscribed on the mobilization states to be drawn up; but, owing to the reserve organization having only come into force from the commencement of 1879, it is improbable that these lists are at present complete, or that they can be made so for some considerable time. As has already been pointed out, the reserve divisions mobilized under former conditions during the late war, four in number, comprising 52 battalions of infantry and 12 batteries, furnished a great proportion of their Officers on the peace establishment, but these were not sufficient to make up the difference between the numbers formerly and now maintained. By the demobilization of the active army and the *dépôt* formations, a large number of Officers were set at liberty, who will have become available for employment again in case of necessity; for excluding altogether the sources already referred to of the local, fortress, and reserve troops under the 1874 formation, there was, at the conclusion of the late war, an excess of about 10,000 Officers over and above the numbers borne previous to mobilization. The establishments were certainly incomplete at that time, but allowing for this, the permanent peace cadres of the reserve battalions can be easily completed from these, and also the increase required to place these troops on a war footing provided for.

It must not be forgotten, however, that this would absorb nearly the whole excess, and leave only a small number to meet the demands of the active army and *dépôt* formations in case of mobilization, when at least the numbers lately dispensed with would be required. The question, therefore, of providing for the increased number of Officers which will be wanted in any future mobilization must be a very hard one, for as we know it is only with difficulty that a sufficiency can be obtained to complete establishments in the ordinary course, and that under the pressure of the last war, admissions had to be sanctioned without any pretence at any educational test. The consequence was that as a number of nominations were made of individuals without any special or general qualifications socially or educationally, and so a restriction was made forbidding their promotion to a higher rank without passing the regulated examination, many still remain in the grade to which they were first appointed with but little hope of advancement.

Germany, as we showed in a former paper, obtains a large proportion of Officers of the lower ranks for her reserve formations from the one-year volunteers, who can be augmented and drawn upon to almost any extent, requiring only a limited, though most thorough and careful course of technical training, which their general education and intelligence enables them to profit by to the utmost. In Russia this is far from being the case, although the institution of volunteers for short terms was copied from Germany in the 1874 law, and is still continued, the terms of service being regulated according to their educational qualifications, which are divided into three categories according to the courses passed through at the several State colleges and schools. They enter the ranks as privates, being promoted non-commissioned officer after two, four, or twelve months respectively, according as they belong to the first, second, or third category, after passing the prescribed examination—and to the rank of Officer after three, six, or thirty-six months respectively, before appointment to which, however, they must have gone through the manœuvres which take place annually at a camp of instruction. Generally speaking, the volunteers had the choice of the corps in which they prefer to serve; and, with the exception of those entering the Guard and the cavalry, they do not have to furnish themselves and pay their own expenses. Notwithstanding, however, these advantages, the number of Officers obtained in this way is very small, on account of the generally low standard of education prevalent in the country, and other means have had to be taken to provide for an adequate supply.

This is done by means of an extensive system of military educational establishments, of several grades, the pupils of which are generally called "Younkers." They are divided generally into preparatory and middle class academies, the former preparing for entry to the latter, which embrace the War Schools and Younker Schools proper. Military academies, or so-called gymnasiums, educate the children of non-commissioned officers and men who are serving for entry into the War Schools, the course lasting six years. In the same way higher academies prepare the sons of Officers and military officials for entrance into the Younker Schools, or for direct employment as non-commissioned officers, the course lasting also four years, and including history, geography, and elementary mathematics.

The War Schools comprise the Paul and Constantine Schools at St. Petersburg, and the Alexander School at Moscow for the infantry, the Nicholas Schools at St. Petersburg for the cavalry, the Michael Artillery School, and the Nicholas Engineer School. The young men who are admitted to these must have already had a general middle-class education, and the instruction, therefore, is limited to purely military and technical subjects, varying according to the particular branch selected. The course for the infantry lasts two years, the "Younkers" being formed at each school into a battalion of 300 strong of 4 companies; so that between the two about 400 are turned out annually, being appointed to regiments with the rank of Ensign. The cavalry schools form a squadron out of 200 pupils, whose course is of the same duration, and admits of about 100 being annually drafted to regiments as Cornets. The course for candidates for the special arms is a year longer, and the number of Younkers less, being 160 for the artillery and 126 for the engineers, turning out annually 50 and 40 for these arms respectively.

Besides these are a special Topographical School; a Corps of pages preparatory exclusively for the Guard, with a strength of 120 and a course of seven years, turning out about 10 annually; and the Finland Cadet Corps. This latter has been instituted especially for the sons of the nobles in Finland, and combines in itself the courses both of the preparatory and middle-class schools. There are 120 cadets borne on its books, of which it turns out about 10 annually after a period of instruction lasting eight years. In all, therefore, about 610 Officers are derived annually by the Army from these sources.

The Younker Schools proper are for the education of such as have received only a very deficient one previously, and the course includes, therefore, general as well as technical subjects. Apart from the pupils received from the academies already referred to, candidates are received amongst the non-commissioned officers of infantry, cavalry, and Cossacks. The whole must have served at least three months, and after a two years' course they are, if successful, nominated Ensigns in the infantry or Cornets in the cavalry, being either appointed definitely to regiments or placed on an unattached list to fill vacancies as they occur. There are separate schools for the infantry, the cavalry, and the Cossacks, which have been yearly increasing in numbers as the requirements have become greater; more especially the latter, which have received a considerable development during the last few years.

In 1878, there were eighteen for the infantry, accommodating 3,730 residents; eight for the cavalry, for 480; and seven for the Cossack troops, with 540; making in all 4,750, of which 1,862 were passed to the various branches, viz., 1,491 to the infantry, 193 to the cavalry, and 178 to the Cossack regiments.

In all, therefore, between the War and the Younker Schools, about 2,500 Officers are obtained annually for the Army. A considerable proportion, however, of these are drawn from the non-commissioned officers or from the class from which these should be provided, and the result naturally is that great difficulty has been experienced in obtaining a sufficient supply of these. With a view to remedy this, considerable inducements were offered by

an Order of March, 1877, to non-commissioned officers to continue their service. These are, a claim to civil employment after an extension of five years, 80,000 places being available for which they are eligible, and the emoluments of which vary from 12*l.* to 105*l.* per annum. After a further engagement of five years, a gratuity of 35*l.* is offered; and after a third extension for the same period, one of 150*l.* or a pension of 14*l.* per annum.

Besides the educational establishments already mentioned for providing an adequate supply of Officers to the Army, there are also a series of higher military colleges for the training of Officers for employment on the General Staff, and for affording special technical instruction to Officers of the scientific branches of the Army.

Passing now beyond the active and reserve formations, there is another portion of the armed strength of Russia which is not to be ignored, and which by comparatively recent enactments and arrangements has gained considerably in importance. This is the *Opoltschénie*, wrongly termed a general militia, which it is not, a portion of it being, in fact, a second reserve to the regular Army, while the rest is in reality a *levée en masse* for home defence.

The Law of 1874 enacted that every man liable to military service, and not taken for the Army or Navy, should belong to the *Opoltschénie* from the completion of his twentieth year until the age of forty. A Law of October, 1876, extended this, and defined the obligations of two categories into which it was divided. To the first of these, or the first ban as it is ordinarily called, belong four classes of men who have completed their Army and reserve service, and any others under the same conditions who have not reached their fortieth year, as well as the four youngest classes of men belonging to the *Opoltschénie*. These can be called out simply by an Imperial Order directed to the Senate, and are liable not only to service in the interior and for home defence, but may be employed in the same manner as the reserve to complete army formations or to form new ones for service in the front. In 1853, 360,000 of the *Opoltschénie* were called out; while in the late war 185,000 of the first ban were embodied by an Imperial Ukase of July, 1877. In both cases, however, these men were entirely raw material, for it will not be until 1883 that the operation of the law now in force will be completed by four classes of men who have passed through the active and reserve services being comprised in the first ban of the *Opoltschénie*.

When this shall be effected, it will be not only a numerous but also a powerful second reserve, which can be fallen back upon to complete existing formations or to create new ones.

If we consider that of the number of about 680,000 young men who annually attain the legal age in Russia and become liable to service, approximately half are exempted on account of family circumstances, remaining liable to serve in the *Opoltschénie*, besides the trained veterans who have passed through the Army, we shall see what a considerable force is represented by the first ban alone.

But, besides this, the second ban represents an enormous force, though the entire absence of organization and training renders it at present almost nominal. The difference between this category and the first ban is, that the former cannot be called out excepting under most exceptional circumstances, by special decree, and then only for purposes of home defence. It can, further, only be employed for the composition of special battalions and squadrons, the strength of which is fixed at 13 Officers and from 638 to 990 of other ranks for the former, and 3 Officers and 134 for the latter. The Officers are chosen by local government and military commissions. For the command of a battalion or squadron the qualification is required of having served the legal period with active formations; while commanders of companies require only an educational qualification, and to have been through

a six weeks' course of manœuvres. In the case of subordinate Officers, the latter test is not required.

In 1878, a list was opened in St. Petersburg for the registry of applicants for appointment as Officers under these conditions, with the result that 5,935 individuals reported themselves, of whom 4,853 were considered qualified. Of these, 464 had previously served as Officers, of whom 124 were candidates for the command of battalions and squadrons, 213 for the command of companies, and 129 for appointment to lieutenancies.<sup>1</sup> Of the remainder, 2,599 were Government officials, 616 who had previously occupied such positions, and the remaining 1,174 were private individuals.

The result surpassed expectation, and the numbers not only sufficed to provide all the formations contemplated for the St. Petersburg region, but would afford a considerable residue for employment elsewhere.

This completes a general review of the regular armed forces raised within European Russia, but it by no means represents the resources at the disposal of the Czar, which are further augmented by an immense number of Cossack light cavalry, a large proportion of which is borne on the permanent establishments; and by the infantry raised in Finland, which, if less considerable in numbers, make up for it by their intrinsic merit.

Of the Cossacks, those of the Don occupy the most important place, being borne in part on the regular establishments even in peace time, a regiment being allotted to every cavalry division. These are considered to be regulars, whereas the fresh formations made in time of war are irregulars. By an Ordinance of April, 1875, the Don Cossacks were assimilated to the rest of the inhabitants of European Russia by the introduction of universal liability to military service. As in the rest of the Empire, those becoming liable are divided into two classes—those taken for permanent service on attaining eighteen years, and the residue, who form an *Opoltschénie*; the whole being liable for service during twenty years.

The permanent service is divided into three terms, the first of which is preparatory and devoted to training which lasts for three years. After this comes the term of active service lasting twelve years, of which, however, only one-third is passed in embodied service in peace time. Sixty regiments are formed of men serving in this term, which are divided into three categories of twenty regiments each. Of these, the first category, comprising regiments numbered from 1 to 20, are always embodied and distributed as already noted between the regular cavalry divisions. The second category comprises the regiments from 20 to 40, which must be always maintained fully equipped and horsed, although the Cossacks forming them are on furlough. The third and last category, from 40 to 60, are also on furlough and must maintain their equipment complete, but they need not be horsed. The number permanently embodied and borne on the strength of the regular cavalry is about 20,500, while the other two classes number about 32,500.

But, besides these, there is a large force of Cossacks borne as irregulars, the numbers of which will be detailed further on, drawn from the districts of the Terek and the Kuban in Europe, and from the Ural, Orenburg, Astrachan, Siberia, and other parts of Asia, a portion of which are permanently embodied for service in the Caucasus, in Siberia, and in Central Asia.

At the time that universal service was inaugurated in Russia an attempt was made to extend the obligation to Finland, but without immediate result, for the Diet refused to accept the proposition without serious modifications, which led to the settlement of the question being deferred until 1878, when a

<sup>1</sup> There is a clerical error here of two men. It is only just to Captain Hildyard to mention, that as he is out of England, he has not had the opportunity of revising the proofs of this article.—L. A. H.

<sup>2</sup> See previous note.—L. A. H.

scheme was adopted by it, and having been ratified by the Emperor, it will come into force from the 1st January, 1881. By it the principle of universal service will be adopted, the legal age being fixed at the completion of the twenty-first year. The military forces thus raised are to be divided as in Russia between the active troops, a reserve and the *Opoltschénie*; and the annual contingent by the Emperor and the Grand Duke on the proposition of the Finland Senate. The terms of service are to be three years in the active army, the obligation to serve in which will be decided by lot, and two years in the reserve. Those who escape army service are drafted direct to the reserve for five years, during the first three of which they are liable to periods of drill and manœuvres, making in the aggregate 90 days. On the termination of service in the reserve, the whole are drafted to the *Opoltschénie* until the completion of their forty-first year.

The active army is brought up to war strength by calling in the reserve, and is available for service throughout the Empire. For the present, at least, the formations are to be restricted to infantry, of which there will be nine battalions of rifles, 5,000 strong, on a peace footing. The *Opoltschénie* is to be provided with cadres from the reserve if called up, and its services are specially restricted to the defence of the country in case of invasion.

This completes a general outline of the military establishments of the Russian Empire, and the arrangements by which these can, according to the latest alterations, be augmented in case of war. To make it practically complete, we propose, in conclusion, to give a brief summary of the normal strength of these establishments, as well as the forces which would be available by their augmentation in time of war.

The armed forces of Russia are comprised under three heads—the active army, the irregular troops, and the *Opoltschénie*.

To commence with the active army, the contingent called up in the autumn of 1879 amounted to 218,000 men, being the same as in the year previous, and 23,000 in excess of the number drawn in 1877. This represents the contingent required by a four years' service, which is the term to be spent with the colours actually in force, though it is asserted that a reduction to three years is contemplated, and has received the Imperial sanction, but is postponed in view of certain difficulties. The total number who attained the legal age was, in 1878, 759,000, of whom 190,000 exemptions were allowed in the first category, and of the numbers drawn for service 3,060 failed to appear, 2,666 being Jews. After the latest modifications the active army has been organized in nineteen army corps, of which one is composed of the Guard, one formed of Grenadiers, fifteen of the ordinary troops, and two specially formed for service in the Caucasus. They are composed of infantry and cavalry divisions as follows :—

Corps d'armée.	Infantry divisions.	Cavalry divisions.
Guard Corps .....	1st, 2nd, and 3rd of Guard ....	1st and 2nd of Guard.
Grenadier Corps ...	1st, 2nd, and 3rd of Grenadiers	14th.
1st .....	22nd, 24th, and 37th.....	1st.
2nd .....	26th, 27th, 28th.....	2nd.
3rd.....	25th, 29th.....	3rd.
4th.....	16th, 30th.....	4th.
5th.....	7th, 8th.....	5th.
6th.....	4th, 6th, 10th.....	6th.
7th.....	13th, 34th.....	7th.
8th.....	14th, 15th.....	8th.
9th.....	5th, 36th.....	9th.
10th.....	9th, 31st.....	10th.



Corps d'armée.	Infantry divisions.	Cavalry divisions.
11th.....	11th, 32nd.....	11th.
12th.....	12th, 33rd.....	12th.
13th.....	1st, 3rd, 35th.....	13th.
14th.....	17th, 18th.....	1st Don Cossacks.
15th.....	2nd, 40th.....	Do.
1st Caucasus.....	Caucasus Grenadiers, 38th.....	1st Caucasus.
2nd Caucasus.....	39th, 41st.....	2nd Caucasus.

Besides these normal formations by Corps d'Armée there are four infantry divisions, the 23rd stationed in Finland, and the 19th, 20th, and 21st in the Caucasus. The whole of the regular cavalry is allotted to the several corps.

*Infantry.*—The infantry is divided into 48 divisions, each of 2 brigades of 2 regiments, in all 192 regiments. Of these 3 divisions are of the Guard, 4 of Grenadiers, and 41 of the line. Until last year only the regiments of the Guard and the divisions stationed in the Caucasus had 4 battalions, of which in the Guard 1 was a light infantry battalion. All were of 4 companies, of which in the Caucasus battalions 1 was light infantry. The remainder of the infantry regiments were composed of 3 battalions, of 5 companies. By an order, however, of April, 1879, the whole of the Guard, Grenadiers, and line regiments are to be formed of 4 battalions of 4 companies, the marksmen, collected previously in special companies, being distributed throughout them. This change necessitated the creation of one new company for each of the 152 regiments affected by it, for in place of these comprising as before 3 battalions each of 5 companies, or in all 15 companies per regiment, they will for the future consist of 4 battalions each of 4 companies, or 16 companies per regiment. Under this organization the strength of the 192 infantry regiments will be as follows :—

	On a peace footing.	On a war footing.
Combatants .....	<div> <div>12,288 Officers.....</div> <div>350,208 non-com. officers, rank and file ... }</div> </div>	<div> <div>15,360 Officers.</div> <div>764,928 non-com. officers, rank and file.</div> </div>
Non-combatants..	<div> <div>1,356 officials.....</div> <div>49,536 other ranks.....</div> </div>	<div> <div>1,356 officials.</div> <div>43,416 other ranks.</div> </div>
Total .....	413,388 all ranks.....	825,060 all ranks.

The increase given by this arrangement over the organization previously in force is in peace as in war 760 Officers, while of combatant non-commissioned officers, rank and file, it is in peace 15,048, and in war as much as 151,848.

Not included in the above are 8 brigades of rifles each of 4 battalions of 4 companies, of which 1 is allotted to the Guard, 5 to line divisions, 1 to the Caucasus Corps, and 1 employed in Turkestan—the strength of which is as follows :—



	On a peace footing.	On a war footing.
Combatants .....	<div> <div>688 Officers .....</div> <div>14,200 non-com. officers,</div> <div>rank and file ....</div> </div>	<div> <div>812 Officers.</div> <div>26,272 non-com. officers, rank</div> <div>and file.</div> </div>
Non-combatants..	<div> <div>60 officials .....</div> <div>2,024 other ranks .....</div> </div>	<div> <div>96 officials.</div> <div>3,584 other ranks.</div> </div>
Total .....	16,972 all ranks .....	30,764 all ranks.

The grand total, therefore, of the infantry establishments is 430,360 of all ranks in time of peace, and 855,824 in war time.

*Cavalry.*—The cavalry establishments in Europe as fixed at the close of 1878 comprise 20 divisions, of which 2 of the Guard, 14 of the line, 1 of Don Cossacks, and 3 for the Caucasus. Each of the Guard and line divisions is composed of a regiment of hussars, 1 of dragoons, 1 of lancers, and 1 of Don Cossacks, while 4 of the latter form the Don Cossack division. The 3 Caucasus divisions comprise 4 regiments of dragoons, and 10 regiments of Terek and Kuban irregular Cossack regiments permanently embodied in the same manner as the Don Cossack formations. The strength of the cavalry forces is as follows:—

*1st. 33 Guard and line cavalry regiments.*

	On a peace footing.	On a war footing.
Combatants .....	<div> <div>1,848 Officers .....</div> <div>23,496 non-com. officers,</div> <div>rank and file....</div> </div>	<div> <div>1,848 Officers.</div> <div>22,968 non-com. officers, rank</div> <div>and file.</div> </div>
Non-combatants..	<div> <div>198 officials .....</div> <div>5,247 other ranks .....</div> </div>	<div> <div>165 officials.</div> <div>5,214 other ranks.</div> </div>
Total .....	30,789 all ranks .....	30,195 all ranks.
Horses.....	20,097 .....	19,569.

*2nd. 21 Don Cossack regiments.*

	On a peace footing.	On a war footing.
Combatants .....	<div> <div>672 Officers .....</div> <div>18,564 non-com. officers,</div> <div>rank and file....</div> </div>	<div> <div>441 Officers.</div> <div>17,934 non-com. officers, rank</div> <div>and file.</div> </div>
Non-combatants..	<div> <div>21 officials .....</div> <div>1,512 other ranks .....</div> </div>	<div> <div>21 officials.</div> <div>1,596 other ranks.</div> </div>
Total .....	20,769 all ranks .....	20,192 all ranks. <sup>1</sup>
Horses.....	19,362 .....	19,530.

Besides these, however, must now be further included the 10 irregular

<sup>1</sup> See previous note.—L. A. H.

regiments permanently embodied in the Caucasus divisions, viz., 7 of Kuban Cossacks, 2 of Terek Cossacks, and 1 Kutais irregular regiment. The former have an establishment nearly the same as the Don Cossack regiments, while the latter number about 300 combatants less, having only 4 squadrons or sotnias, whereas the Don and Kuban regiments have 6. We may, therefore, estimate them at about 12,000, with a like number of horses. The total of cavalry, including those permanently embodied, is about 63,558 of all ranks, and in war approximately the same, though somewhat less owing to a number of Officers and men being drafted to new formations, no less than 231 of the former being so transferred from the Don Cossack regiments alone. The number of horses on a war footing is about 50,000, which may be taken as the combatant strength of all ranks.

*Field Artillery.*—Each infantry division has attached to it a field brigade of 6 batteries, each having 4 guns horsed on a peace and 8 on a war footing. Thus, there are 3 Guard, 4 Grenadier, and 41 line brigades, besides 2 in Turkestan, 1 in Eastern Siberia, and 1 in Western Siberia. There are also 6 independent mountain batteries of 6 guns, and half a battery in the Caucasus. In all there are in European Russia  $291\frac{1}{2}$  batteries, with 1,162 guns on a peace and 2,326 on a war footing, while in Asia there are 11 batteries with 44 or 88 guns, as the case may be. In each brigade there are 3 heavy and 3 light batteries. Leaving those in Asia out of the calculation, the strength of the field artillery in Europe is as follows :—

	On a peace footing.	On a war footing.
Combatants .....	$\left\{ \begin{array}{l} 1,746 \text{ Officers} \dots\dots\dots \\ 49,555 \text{ non-com. officers,} \\ \text{rank and file} \dots\dots \end{array} \right\}$	2,040 officers.
Non-combatants..	8,162 all ranks .....	71,731 non-com. officers, rank and file.
		10,202 all ranks.
Total .....	59,763 <sup>1</sup> .....	83,973.
Horses .....	11,367 .....	55,053.

*Horse Artillery.*—The Guard has a brigade formed of 6 batteries, one of which is Cossack, but with this exception, there is no higher organization of the horse artillery batteries, which number 21 ordinary and 7 Don Cossack batteries, 2 being attached to each division. Besides these there are 4 Kuban and 1 Terek Cossack batteries permanently attached to the Caucasus divisions, and a mountain battery in Turkestan. In all, therefore, there are 35 horse artillery batteries with 210 guns in peace and in war. The following is the strength comprised in these :—

	On a peace footing.	On a war footing.
Combatants .....	$\left\{ \begin{array}{l} 210 \text{ Officers} \dots\dots\dots \\ 6,615 \text{ non-com. officers,} \\ \text{rank and file} \dots\dots \end{array} \right\}$	245 Officers.
Non-combatants..	1,085 all ranks .....	8,225 non-com. officers, rank and file.
		1,330 all ranks.
Total .....	7,910 .....	9,800.
Horses .....	5,740 .....	8,960.

<sup>1</sup> See previous note.—L. A. H.

*Engineers.*—There are 15 battalions of engineers, comprising 1 Guard, 1 Grenadier, 10 line, and 3 Caucasus battalions, besides 8 pontoon and 3 railway battalions, 1 pontoon battalion for the Caucasus, 2 torpedo companies, and half a battalion of sappers in Turkestan, making in all 27 battalions and 5 companies. These are organized in 5 sapper brigades, one of which for the Caucasus, each of which is composed of 3 sapper, 2 pontoon and 1 railway battalion with a park. In time of peace each battalion has 5 companies, one of which is drafted on mobilization forming a dépôt battalion for each brigade, besides 20 reserve sapper companies. The strength of these brigades is as follows :—

	On a peace footing.	On a war footing.
Combatants .....	642 Officers .....	580 Officers.
	16,630 non-com. officers, rank and file.....	23,891 non-com. officers, rank and file.
Non-combatants..	2,423 all ranks.....	2,643 all ranks.
Total.....	19,635 .....	27,114.
Horses .....	.....	5,406.

*Transport.*—Previous to the late war against the Turks the transport was based upon the regimental system, a train of 44 waggons being provided to each regiment. In May, 1878, however, this having been found insufficient, a provisional organization was introduced by which each army was provided with an organized train divided into 4 divisions, having each a war formation of 5 Officers, 750 non-combatants, 1,174 draught horses, with 116 in reserve. Supposing, therefore, the forces to be formed into three armies of operation, there would be required 15 Officers, 2,250 non-combatants, and 3,870 horses.

*Ammunition Columns.*—Each infantry division has a flying divisional column divided into 3 artillery and 2 infantry divisions, comprising 130 six-horsed waggons. A cavalry column of 24 two-wheeled carts is attached to each cavalry and Cossack division. The brigades of rifles have each 16 ammunition and 5 other carts. In peace these have small cadres of Officers and men, but no horses, whereas in war some 38,000 would be required to horse the 7,000 waggons. But besides these, after their completion upon mobilization, 14 movable artillery parks are formed as a reserve, each of 4 divisions. These 56 divisions have each 48 waggons, making nearly 3,000 more to be horsed. They are allotted one to each infantry division, and the remainder for new formations.

There are two siege trains, each of 400 guns, one of which for the Caucasus, and also reserve artillery parks with ammunition dépôts, small arm dépôts, and workshops.

58 six-horsed pontoon waggons, carrying 56 half pontoons and 2 anchor boats, provide 700 feet length of bridging, and constitute the pontoon train. The engineer train consists of field, siege, engineer, and telegraph parks, being attached one to each sapper brigade in peace time. In war field engineer parks carry materials and tools for field intrenching. There are two siege parks attached respectively to the 2nd and 3rd sapper brigade. Each is in 4 divisions, one of which suffices for the siege of a fortress. Two telegraph parks are attached to each sapper brigade, and one to the Caucasus.

The sanitary establishments comprise a regimental hospital to each battalion for the temporary reception of patients. To each division a divisional hospital is attached, accommodation being afforded for 170 men in each, which are

intended to be grouped as circumstances require. Besides these more stationary provisional hospitals are established in rear as required, each for 60 Officers and 600 men. There are 48 bearer companies organized and trained in peace time, the men being selected from the line from which they are not withdrawn except in case of mobilization, when they are drafted to the divisional hospital establishments.

*Reserve.*—As has already been noted, the reserve formations are maintained in peace on a cadre establishment, there being 1 Guard and 96 line battalions, which are in time of war expanded to form 24 reserve divisions and 101 independent battalions. The peace strength differs in some degree from a large proportion of the battalions having on their rolls the cadres of *depôt* battalions. The total numbers of the reserve troops is as follows :—

	On a peace footing.	On a war footing.
Combatants . . . . .	3,304 Officers. 49,056 non-com. officers, rank and file . . . . .	9,801 Officers. 477,920 non-com. officers and men.
Non-combatants..	10,808 all ranks. . . . .	26,016 all ranks.
Total . . . . .	63,168 . . . . .	513,737.

A project has been talked of for the formation of a 5th and 6th squadron to cavalry regiments to serve as a reserve, but this has not as yet been effected. The artillery is also without any permanent reserve formation, but 68 batteries equipped during the late war are available so far as material is concerned. The engineers are provided with a reserve in time of war by means of the 5th companies, giving a total of about 5,620 of all ranks.

*Depôt Troops.*—Cadres for the *depôt* formations are borne on the rolls of 82 reserve battalions, in the proportion of 2 to each, in the districts to which the regiments belong to which they are intended to serve as *depôts*. Beyond these there is in peace no permanent organization. In war they form 199 battalions, with 5,771 Officers, 222,084 non-commissioned officers, rank and file, and 41,989 non-combatants, in all 269,844. Of this number 37,000 form a permanent establishment, whilst the rest are for the purpose of being drafted to the front to fill vacancies, their places being supplied by reserve or *Opoltschénie* men so as to maintain the establishment complete.

In the cavalry, *depôt* squadrons are maintained in time of peace, those of the line being formed into *depôt* brigades quite independent of their regiments. In the Guard it is different, the squadrons composing the *depôt* brigade of the Guard being always connected with their regiments in a certain degree. The *depôts* of the Caucasus regiments are formed by a fifth squadron, which remains present with them. The Don Cossack regiments have no *depôt* formation. There are, therefore, in all 56 *depôt* squadrons, numbering in peace 14,056 of all ranks, with 6,720 horses, with an increment of about 5,000 on a war footing. They are composed of a permanent and variable portion, and a remount detachment for training remounts.

The artillery *depôts* consist in peace time of 4 field artillery brigades of 6 batteries. On mobilization these 24 batteries form cadres to 48 batteries, one for each artillery brigade, and also 48 reserve batteries. The peace establishment is 4,308 of all ranks, 444 horses, and 96 guns, which to effect the completion of the above formations must be raised in time of war to 71,528, with 5,184 horses and 384 guns.

For the horse artillery there are 3 *depôt* batteries, including an instructional

one, comprising in peace 635 of all ranks, with 387 horses and 18 guns, and in war of 2,536, with 531 horses and 18 guns.

From the 5th companies of engineer battalions 5 dépôt battalions are formed, each of 4 companies, which have no existence in time of peace. They number 5,425 of all ranks.

*Local Troops.*—The local troops are divided into several categories, viz., those available for service in the front, but not included amongst the field troops of the several arms already enumerated; those for service in the interior; the instructional formations; and, lastly, the auxiliary troops. Under the first head come the formations which, while primarily instituted for frontier service, are now chiefly employed in garrisoning fortresses and towns in the Caucasus, in Turkestan, and other portions of Asia, amounting in all to 36 battalions. Of these 7 are stationed in the Caucasus, 2 at Orenburg, 17 in Turkestan, 4 in West Siberia, and 3 in East Siberia. The total strength of these battalions amounts to about 23,148 of all ranks in time of peace, and 40,653 on a war footing, of which 11,339 and 19,142 respectively are borne on the Turkestan establishments. Besides the 7 battalions above-mentioned as belonging to the Caucasus Army, there is also an infantry fortress regiment of 3 battalions at Alexandropol, which is the only remnant in Europe of the permanent garrison infantry which has been superseded by the introduction of the reserve troops.

By an order of October, 1876, the garrison artillery underwent a complete reorganization, being formed into 47 battalions of 4 companies with 2 independent companies in Europe, 3 battalions of 4 companies and 4 independent companies in the Caucasus, and 4 companies in Asia. Each battalion numbers about 470 of all ranks on a peace footing, and three times that strength on the war establishment, giving 24,668 of all ranks in Europe in the former case, and 69,782 in the latter. In Asia the strength does not vary, being 700 in the 4 companies.

The second category of local troops is restricted to those which are limited to internal local service. By the 1878 organization most of those also were merged into the newly created reserve formations, but a few battalions still remain in the distant governments of Archangel, Perm, Ufa, &c., and a number of smaller detachments in places where neither field nor reserve troops are available for local service. Thus there are in Europe 7 local battalions of from 500 to 900 men, 491 local establishments of from 20 to 100 men, and 40 escort detachments of from 30 to 50 men, not including the Caucasus, where 3 local battalions and 59 local detachments are still in existence; representing in all about 40,000 men. In Turkestan there are 2 local battalions and 2 detachments, and in Siberia 6 battalions, 43 detachments, and 37 escort detachments, of which the latter are occupied in escorting the convoys of prisoners transported to Siberia.

The gendarmerie comes also under this head; it is formed into 3 divisions, with head-quarters at St. Petersburg, Warsaw, and Moscow. Besides these, however, there are 1 Guard and 5 line detachments in peace on a cadre formation, which in time of war are expanded into as many squadrons for military police duties in the field, numbering 1,100 of all ranks.

Under the head of instructional troops there is an infantry battalion of 5 companies, which during the late war was expanded into a regiment; a squadron of cavalry; a field and a mounted battery, each having 4 guns equipped; a Caucasus company; a Cossack artillery subdivision, and a telegraph company.

The fourth and last category of auxiliary formation includes veteran companies of Grenadiers and Guard, local artillery and engineer dépôts, and arsenals and discipline battalions.

*Irregular Cavalry.*—The next class of armed force in Russia to be considered is that of the irregulars, composed for the greater part of Cossacks. The

most extensive body of these is drawn from the Don district, and comprises no less than 60 regiments each of 6 sotnias or squadrons. As has already been explained, one-third of these are on permanent duty, and to the strength of some 20,460, is included in the regular establishments; while the remainder, about 32,000 strong, are borne as irregulars. Besides the cavalry formations there are also 8 batteries, one of which of the Guard, each of 6 guns, included in the regular formations; while, on mobilization, 22 batteries are formed, giving 48 guns with the regulars and 84 to be disposed of elsewhere. The Kuban Cossacks with a peace formation of 10 regiments, 2 rifle battalions, and 5 mounted batteries provide in time of war a contingent of 28,600 horsemen, 1,400 foot, and 30 guns; while the Terek district finds permanently 5 regiments and 2 batteries, with a liability to place in the field some 7,500 horse and 8 guns. The Ural Cossacks maintain 4 regiments as a normal formation, numbering in case of mobilization 7,200 horsemen. In the Orenburg district 5 regiments and 4 batteries are maintained on a peace footing, which in war time are expanded to 13,634 horses and 52 guns. Of these and of the Ural Cossacks a proportion is always employed in Turkestan. Besides these there are the Astrachan, Siberian, Semirätschensk, Transbaikai, and Anner formations, in all about 12,000 horse and 8,000 foot employed for local service, a proportion of them being permanently embodied.

Apart from the irregular Cossack formations there is in the Caucasus a militia organization, which has been extended on a limited scale to the newly acquired territory of Kars and Batoum.

*Opoltschénie.*—There remains only the Opoltschénie, which has already been considered, so far as it is possible to do so without trustworthy data. The numbers actually liable to embodiment in certain cases under this head is large; but as until 1883 the new law will not have taken full effect, and at the present time only one class of men who have passed through the ranks of the Army is included in its first ban, it can only be regarded as a source from which utterly raw material can be drawn. So soon as it becomes possible, however, there can be little doubt but that the first ban will be organized in such a manner as to act towards the field army as the German *Landwehr* does.

NOTE.—The information contained in this paper, and in a previous one, on the reserve formations of other European armies, has been principally derived from the *Revue Militaire de l'Etranger* for 1878-9, and from the "Jahres-berichte über die Veränderungen und Fortschritte im Militärwesen," by Herr von Löbell, published annually by Messrs. Mittler and Son, for the years 1874 to 1879.

## THE CONSTRUCTION OF MILITARY RAILWAYS DURING THE RUSSO-TURKISH WAR OF 1877-78.

Contributed by Captain SALE, R.E.

THE question of transport and communication is one which demands from the military student the closest and most serious attention.

Somewhat lost sight of of late amongst the interminable discussions on the minutiae of tactical formations, it has hardly received the attention it deserves, and though this branch of the military art has undoubtedly exercised a greater influence on the fate of armies, and therefore of nations, than the more picturesque attributes of warfare, yet it has been slurred over by almost all military historians even when not entirely ignored.

How little we know of the arrangements for transport which obtained in the armies of ancient Rome, and yet it was probably to the excellence of their organization in this respect rather than to their individual qualities that their astonishing successes were due.

Amongst modern wars the Russo-Turkish campaign of 1877-78 is one which illustrates very forcibly the way in which the decisive movements depend on questions of transport. For example, at the crisis of the campaign after the failure of the second attack on Plevna, it can hardly be doubted that the fate of that campaign at least would have been very different if the Turkish armies at Plevna and on the Jantra had been really mobile and properly organized as regards transport.

Again, amongst the questions of transport and communications that of the communication between the base and the strategic centre of operations is of paramount importance. For such lines of communication in great campaigns railways are indispensable (unless, indeed, there should be communication by sea), for the growth of armies in modern times has been so rapid, and their impedimenta have so increased, that ordinary roads have long ago ceased to be adequate to their requirements.

Here also the Russo-Turkish campaign, with especial reference to the Russian movements, illustrates very instructively the consequences of under-rating the requirements of a large army, the absolute necessity for railway communications, and also what can be done in time of war to supply deficiencies in this respect.

In Russia itself—thanks to the prudent foresight of the Emperor Nicholas and the severe lessons of the Crimea—a tolerably complete network of railways adapted for military requirements had been formed, which enabled the concentration on the Russian frontier to be made with comparative ease.

But between the Russian frontier and the centre of strategic operations there intervened a distance of 527 miles, of which only a part was traversed by a somewhat precarious single line of railway, supplemented by roads indifferent at the best, and soon rendered well nigh impassable by wet and wear.

Then at the terminus of the railway a great river had to be crossed and the remaining distance traversed by common roads.

Thus it will be seen that both in the Franco-German and Austro-Prussian campaigns, and also in the American War, the transport difficulties were small as compared with those which the Russians had to contend with.

As a consequence the works of railway construction undertaken during this campaign were on a much larger scale than anything previously attempted during actual warfare.

At the outbreak of the Russo-Turkish War, though the necessity for railway communication was fully recognised, yet it was hardly supposed possible that a considerable line of railway near the scene of actual operations could be made during the war in time to be of use before the end of the campaign.

Previous experience had justified this view. During the American War but little had been done in the way of construction of new lines, though very remarkable work in restoration of railways, and especially in bridge construction, had been executed.

In the Franco-German War what short lines were made were neither so speedily constructed nor so successful in result<sup>1</sup> as to encourage the idea that lines of any length could be made during a campaign.

<sup>1</sup> The longest line made by the Prussians was that turning Metz before the capitulation; it was  $22\frac{1}{2}$  miles long; made with such severe curves and gradients that only four trucks at a time could be taken, and that with frequent derailments, it was worked for twenty-six days only, as the only bridge on the line was then carried away by floods.



The Austro-Prussian War was so short that railway construction was out of the question.

Our own experiences in this respect were not encouraging; 5 miles in the Crimea of a sort of tramway made very slowly and worked clumsily, and 11 miles of track in Abyssinia which took *four months* to construct.

But the Russo-Turkish War has shown us by actual accomplished results that where railways do not exist they may be made during the actual progress of a campaign, provided always that the nature of the country does not present insuperable difficulties.

This offers new points of view for strategical problems by importing new conditions, and hence a knowledge of what was actually done in this way during the war should have a peculiar interest to the military student.

It is now known that the plan of the Russo-Turkish campaign of 1877, as projected by the Russian Staff, involved rapid movements in order both to paralyse the defence and to get the war over before the end of the summer.<sup>1</sup>

It was hoped by rapidity of movement so to shorten the campaign as to get over the grave difficulty felt to exist in the difficult and precarious communication between the Russian frontier and the seat of war.

The movements at the outset were well executed; the bridge over the Sereth was seized, and, thanks to the supineness of the Turks, that vital point in the communication was made secure, and the Russian forces were got into position on the Danube.

Then, after some delay caused by the unusual height of the river and the difficulty in getting up the bridging material by the Roumanian railways, the passage of the river was effected, and a rapid dash secured the pass over the Balkans.

Then came the check at Plevna, and as soon as it was certain that Osman Pasha had firmly established himself there, it was apparent that the campaign could no longer be decided by a sudden dash.

Directly a prolonged campaign became inevitable, the question of communication forced itself on the Russian authorities; and it was seen that the railway communication across Roumania and to the rear must be perfected, and that at once.

It was determined to construct the following new lines, viz. :—

- (1.) From Bender to Galatz.
- (2.) From Fratesti to Simnitsa.
- (3.) (Subsequently) from Sistova to Tirnova. These in addition to certain minor works of railway construction.

#### *The Line from Bender to Galatz.*

The construction of this line had been under discussion for some time even before the declaration of war; and it was practically decided on in June, 1877, though it was not until the end of July that it was actually commenced.

It was felt from the first that the communications along the Roumanian lines were so roundabout and so precarious, both from original faulty construction and defective maintenance, and also from the fact that the Roumanians, though nominally allies of the Russians, were by no means willing allies, that a direct connecting line between the Odessa railways and the Danube at Galatz would offer immense strategical advantages.

<sup>1</sup> The plan of the campaign was to seize the bridge over the Sereth, near Braila; to throw one army corps into the Dobrudscha to guard against flank attack from that quarter; to cross the Danube at some point between Nikopolis and Rustchuk; to mask the Quadrilateral by a force along the Jantra or Lom, to protect the right flank by a force on the Vid or the Isker, and then to push straight on with the main force across the Balkans to Adrianople.

It was at first desired to make a purely temporary line to be used during the war only, but it was seen that the commercial interests of Odessa would be so greatly benefited by a direct connection between that town and Galatz, besides the ulterior strategical advantages accruing to Russia from the existence of such a direct communication, that it was determined to make a more permanent line, having a single track and provided with sufficient stations and shunting places to admit of seven trains each way passing during the twenty-four hours.

A project for the construction of this line as a part of the Russian network of railways had in fact been drawn up some time before the war by the railway administration—indeed in that Bureau it was set down as a railway to be taken in hand at an early date.

Certain preliminary surveys had been made and a great part of the line had been traced; as soon, however, as it came to be necessary to construct the line in the shortest possible time, this preliminary trace was discarded as it involved crossing the principal drainage lines of the country, and necessitated the construction of several high embankments which could not be rapidly thrown up, and even when made could hardly be used at once.

Hence the trace which had been worked out was abandoned and an entirely new line taken which turned several of the watercourses and was less direct, but which, on the other hand, reduced the earthwork and bridging to a minimum.

One gets here an instructive example showing the radical difference in the conditions for tracing military lines where speed of construction is the primary object, and those which obtain for railways made in peace time.

As eventually constructed the line was 189 miles long; for the greater part of this distance the gradients did not exceed  $\frac{10}{1000}$ , but over about  $\frac{1}{3}$ th of the whole, they were in places from  $\frac{10}{1000}$  to  $\frac{18}{1000}$ .

As regards the curves: 64 per cent. of the whole line was straight, 26 per cent. in curves of a greater radius than 600 metres, and the remainder in curves of radii between 600 and 300 metres. In the station of Galatz there were some very short curves of 140 metres radius.

Throughout the line the nature of the soil is favourable for earthwork; but on approaching the Danube several long embankments were required (notably one near Galatz,  $3\frac{1}{2}$  miles long) to carry the line across the low-lying lands often flooded to a considerable depth at the rise of the river.

Here embankments had to be protected against the action of waves.

Moreover, there were parts of the line where it was carried along the margin of a lake where it had to be very solidly constructed to resist wave action, and abundantly provided with waterways.

It was necessary to bridge several rivers, the largest being the Pruth, which was crossed in a very oblique direction in order to take advantage of an existing causeway, and an additional difficulty was caused by the necessity for providing an opening for the passage of the river traffic.

This difficulty was got over by the use of a sort of improvised substitute for a "*pont roulant*" consisting of a pair of timber girders which could be floated into or out of place by barges.

This and all the other bridges were of timber, the piers being of trussed piles, and the spans for the most part inconsiderable.

The line was made by contract, with a system of sub-contracts for the earthwork. Great difficulty was experienced in getting the necessary labour, more especially skilled labour, and the work was grievously hindered by the numerous saints' days of the Roumanian calendar, on which, as also on Sundays, the labourers refused to work.

Nevertheless, in spite of difficulties, in one hundred days from the commencement of the work, of which fifty-eight only were working days, the line was made and trains were running.

This is a very remarkable achievement, of which the Russians have reason to be proud, for it represents a progress of over 3 miles per working day.

*The Line from Fratesti to Simnitzer.*

At the outbreak of the campaign the only line of railway available for communication with Bulgaria terminated at Giurgevo. Between Giurgevo and Simnitzer, there intervened a distance of 40 miles; the whole traffic of the main line of communication of the Russian Army had to pass across this interval by the roads of the country.

These roads were soon worn out, and the first rains in August sufficed to render them almost impassable, so that the road was strewn with the carcasses of dead cattle, and it became evident that if the communications were to be maintained, Simnitzer must be joined to the Roumanian railway system.

On the 15th September, 1877, the contractor for the Bender-Galatz line was called upon to construct a railway from Fratesti (on the Bucharest-Giurgevo line) to Simnitzer, to provide a railway ferry across the Danube, and to continue the line into Bulgaria.

Frategi was chosen as the point of departure of the new line because the terminus, Giurgevo, was under the fire of the Turks at Rustchuk.

On leaving Frategi, the new line attained as soon as possible the margin of the low lands liable to inundation, and followed this margin to Simnitzer. At first it was so traced as to go close to the left bank of the Danube, in the vicinity of Rustchuk, but the annoyance caused by the artillery fire of the Turks made it necessary to divert the line so as to take it out of range.

The total length of this line was 40 miles, and with the exception of an embankment  $1\frac{1}{2}$  miles long, and 14 feet high, to cross the low lands where the River Veda joins the Danube, no important earthwork was required.

The bridging included three rather large openings, one of 420 feet and one of 210 feet for the passage of the Veda, and one having 210 feet opening at the branch from Simnitzer to the banks of the Danube.

All the bridges were of wood, braced piles being used as piers without any considerable spans.

Very great difficulties had to be got over in the construction of this line; not only did heavy rains prevail, but there was extreme difficulty in getting up the materials for the permanent way, owing to the Roumanian railways being choked with the military traffic, and also to the use of roads being put out of question, even had they been in a state fit for use, by the urgency of the military requirements for draught horses. But in spite of difficulties, the formation level of the line, commenced in the middle of September, was completed by the end of October.

Owing, however, to the aforesaid delay in delivering the materials for the permanent way, the line could not be opened until the commencement of December.

*Railway Passage of the Danube at Simnitzer.*

To provide for passing loaded trucks across the Danube so as to avoid breaking bulk, a system of floating bridges somewhat similar to those which ply between Portsmouth and Gosport was adopted.

The floating bridges were purchased from the Rhine Railway Company, by whom they had been used for railway traffic across the Rhine, before the construction of fixed railway bridges on that river.

They were long and broad iron barges provided with a railway track, laid along the deck, and warped across the stream by fixed chain cables, and provided with movable rail ramps for running the wagons on from the shore to the deck.

Two such barges were provided, it being calculated that each one could carry 170 wagons across both ways each day of fourteen hours.

This mode of bridging the river was of course a poor substitute for a fixed railway bridge, as only a very limited number of wagons could be taken across, and the communication was liable to be interrupted by ice.

The floating bridges were delivered by railway in parts, but only after such protracted delays that it was not possible to put the barges together and launch them until after Rustchuk was occupied by the Russians; they were therefore never actually used at Simnizza, as the Fratesti-Simnizza line ceased to be required directly the Rustchuk-Giurgevo crossing was available.

The barges were eventually transferred to Rustchuk.

*Railway from Sistova to Tirnova in Bulgaria.*

It was decided to construct this line on the 15th September, 1877. At first it was determined to take the line by way of Vardine, Novigrad, and the Valley of the Stridenara, as far as Gorni Studen, but after the earthwork had been actually commenced, strategical reasons caused the military authorities to order that it should be shifted further away from the Valley of the Jantra. The line then taken was 75 miles long and had gradients as high as  $\frac{1}{1000}$ , and curves of 150 metres radius.

By the time this second commencement had been made, and the earthwork was well in hand, it became evident that from the block of traffic on the Roumanian lines, the transport of the materials for the permanent way could not be effected in time for the railway to be of any use in the campaign. Moreover, the passage of the Danube was interrupted by ice. It was, therefore, decided to discontinue the line.

In addition to the three principal lines of railway which have been described, a number of minor works of railway construction were executed, including amongst them the placing of a narrow gauge line ( $4' 8\frac{1}{2}"$ ) between Ungeni and Jassy on the same sleepers that carried the previously existing Russian ( $5'$ ) gauge line between these stations. This was done to admit of either of these two stations being used for the transshipment of goods from broad to narrow gauge trucks and *vice versa*.

*Permanent Way.*

On the Bender-GalatZ Railway, the gauge being 5 feet, the specification provided that iron rails (flat footed), of not less than 65 lbs. per yard, or steel rails of not less than 60 lbs. per yard, should be used.

The sleepers of minimum length of 8 feet were to rest in a layer of ballast of  $8\frac{1}{2}"$  mean thickness. On the Fratesti-Simnizza line the gauge was  $4' 8\frac{1}{2}"$ , the other conditions being the same.

*Rolling Stock.*

The existing railways in Roumania, and also in Russia, were so badly provided with rolling stock that it was necessary to provide the new lines with a complete equipment of locomotives and wagons. Energetic measures were taken by the contractor, and all Europe was requisitioned for the necessary supply, so that for the Bender-GalatZ line alone, 80 locomotives, and 1,350 trucks and wagons were purchased and delivered in time for the opening of the line.

For the Fratesti-Simnizza line, 29 locomotives and 800 wagons were supplied, and in this case the trucks were at once utilized by being loaded up with the materials for the permanent way of the line.

The whole of the above-mentioned rolling stock was purchased for the new line, and at the conclusion of the war was conveyed within the Russian frontier, and packed at Ungeni, on sidings specially made for that purpose, no less than eight miles of track being required.

It should be added that both lines were provided with station buildings, and workshops, made for the most part of wood, but well and solidly built.

To sum up. Within little more than four months, during actual war and whilst military operations were in their fullest activity, over 230 miles of new railway were made, the earthwork of some 75 miles of additional line well advanced, a rolling stock of 120 locomotives, and 2,150 wagons and trucks (all new) purchased and delivered, and a steam railway ferry over the Danube provided for, and all this in addition to a number of minor railway works.

The credit is almost wholly due to a well-known Russian railway contractor, M. Poliakoff, who had practically *carte blanche* from the Russian Government as regards expenditure. It offers a striking example of what can be done by energy and liberal expenditure, when free of administrative entanglements, and marks a distinct step in the application of science to warfare.

NOTE.—Valuable information on this subject is contained in a pamphlet, "De la Construction des Chemins de Fer en Temps de Guerre ; Lignes construites par l'Armée Russe pendant la Campagne de 1877-78," by P. Lessar. Translated into French from the Russian by L. Avril. The price of the pamphlet is 6 fr. 50 c.—L. A. H.

---

## NOTICES OF BOOKS.

---

*Torpedoes and Torpedo Warfare: containing a complete and concise account of the rise and progress of Submarine Warfare; also a detailed description of all matters appertaining thereto, including the latest improvements.* By C. W. Sleeman, Esq., late Lieutenant R.N., and late Commander Imperial Ottoman Navy. With fifty-seven full-page Illustrations, Diagrams, Woodcuts, &c. Portsmouth: Griffin & Co.; London: Simpkin, Marshall, & Co., 1880. Size 10" x 6". Price 24s.

It may be as well to begin by stating what we suspect will prove the chief obstacle to the success of the above work: that is its rather high price. Publishers must be expected to know their business, and probably both those who have brought out Commander Sleeman's book, and the author himself, are satisfied that they have not put the cost of it beyond the means of the persons most likely to wish to purchase it. We hope that this may prove correct, as the volume will make a very desirable addition to the library of any naval Officer who is intent on keeping up his knowledge of the manifold duties of his profession at the present day. But, unfortunately, the naval Officer's purse is not always too well filled, even when he is on full-pay, and when on half-pay he may not unnaturally hesitate to expend the income of several days in a single volume, however interesting and instructive. We do not mean to convey the impression that the price demanded is more than the book, as published, is worth. It is neatly, even handsomely bound, is well printed on good paper, and has a large number of illustrations, some of them especially accurate and clear. All these things, independent of the intrinsic merits of its contents as a work of instruction, have to be paid for; and as it can only appeal to a limited public, the sum charged for it does not seem too large. But Officers desiring to obtain some knowledge of torpedo warfare, or to refresh that gained in passing through a course on board Her Majesty's ship "Vernon," would, very likely, have preferred a more concise and less costly volume. We feel that these remarks are not out of place, as the persons to whom a work of the sort is most necessary, are those who, from being on shore or employed on certain special duties, are pretty sure to be precluded

from consulting the confidential text-books, in which alone any comprehensive scheme of torpedo instruction is to be found.

That the want of a book of the kind has been widely felt, is unquestioned ; and this want it has been Commander Sleeman's object to supply. He tells us that he has obtained the information which he desires to impart to his readers while "practically engaged in torpedo work at home and abroad," and from the study of several books and periodical publications which he enumerates. Most of these are well-known in the Navy, and probably few Officers who have interested themselves about torpedoes are unacquainted with them, or, at all events, most of them. The author does not appear to be aware of the labours of Von Ehren Krook in Germany, or of Dandénart and others in Belgium, from whose pens several short treatises on Sea-Mines, Submarine Warfare, and Fish-Torpedoes have appeared. But of such materials as he was in possession of, he has made, on the whole, a not unskilful use. The book begins with a short sketch of the early history of the torpedo ; the first employment of which he attributes to the Italian engineer, Giambelli—whose name is twice mis-spelt, once in the text, and again, in another way, in the synopsis at the end of the volume—at the Siege of Antwerp in 1585. Other authors have fixed the introduction of the weapon at a remote date, but the exact epoch at which it was first made use of is not of much importance if we give the proper significance to its subsequent history. Both in this preliminary sketch and in other parts of his work, where he touches on the history of submarine warfare, the author unaccountably omits all reference to the adoption of the stationary torpedo, and the attempts to devise an offensive torpedo-boat in the Schleswig-Holstein War several years before the campaigns in the Crimea and the Baltic.

After a few remarks on the existing state of torpedo warfare, he passes on to the instructive part of his book. This is divided into several distinct portions:—Defensive Torpedo Warfare ; Offensive Torpedo Warfare ; Torpedo Vessels and Boats ; Explosives ; Torpedo Experiments ; The Electric Light ; and a short chapter on Electricity. Under the two first-named heads, the author notices, at some length, the several kinds of mines and torpedoes commonly employed, the systems of laying them down or manœuvring them, and the appliances for exploding, securing, and testing them. Detailed explanations are given of many of the inventions which have imparted such an immense impulse to the tactics of the torpedo within the last few years. We may remark that he makes no allusion to the locomotive torpedo invented by Captain Ericsson. Nor does he give us any account of our own torpedo vessel, the "Vesuvius." At the end of the book there is, in a tabular form, a "Synopsis of the principal events that have occurred in connection with the "history of the Torpedo," which makes a convenient table of reference.

The manner in which the author has executed the task which he had set himself is on the whole satisfactory. To any one not actually engaged in instruction in one of the great torpedo schools of our own or other countries, and, therefore, not thoroughly conversant with all that has been, and is being done, with the regard to the formidable weapons under consideration, it would, no doubt, be difficult to write a book on the subject, which should prove greatly superior to that before us. The plan on which the earlier chapters are conceived, viz., one closely resembling a series of notes taken by an attentive student during a course of lectures, interspersed with minute descriptions of the many appliances of which illustrations are given in the plates with which the volume is enriched, will be found of considerable advantage to those desiring to derive instruction from it. In the estimate of the advantages and disadvantages resulting from the employment of any particular system of attack and defence, or of any particular apparatus, the author seems to follow official precedents, and it is difficult to discover how



far we have his own opinion on these points. This is, no doubt, proper if the book is to be the first manual of this branch of an Officer's studies, which may be put into the hands of one about to attend the periodical course on board the "Vernon."

In the descriptions he gives us of many different appliances and contrivances, electrical and mechanical, the author rigidly follows published descriptions. In many cases his authorities have undoubtedly been descriptive accounts in the newspapers. Much of his book is occupied with what is probably little different from a literal transcript of passages published under the title of "Notes on Torpedoes," in several numbers of the technical journal "Engineering." These "Notes" were both interesting and valuable, and we are glad to see that so large a portion of them is now published in a permanent form, and is thus made conveniently accessible to those who wish to render themselves acquainted with the chief appliances devised for use in torpedo warfare. Other descriptions have no less evidently been taken from those commendatory paragraphs which give accounts of new inventions in the newspaper press. They are, as a rule, accurate as long as they are confined to describing, but directly they are found to estimate merits they should be regarded with suspicion, and all their statements should be carefully weighed, as they are almost invariably communicated to the papers, more or less directly, by the inventors themselves, or someone interested in the success of their inventions. This must be borne in mind by any person who consults Commander Sleeman's book; as he has undoubtedly not been at much pains to exercise his judgment and tell his readers what to accept and what to reject. The account of the Lay Torpedo, for example, looks exceedingly like a *verbatim* copy of page after page of the specification lodged in the Patent Office. This document not unnaturally takes a very elevated view of the capabilities of the weapon; one which it would be extremely hazardous for any one called upon to use it to take without having first tested it or learned its merits from a qualified instructor.

The "feature" of the book may, perhaps, be said to be its description of Mr. Whitehead's invention, and the revelation of the secret of that formidable contrivance. The propriety of divulging this has been rather questioned, on what grounds we confess ourselves altogether unable to understand. The writer of the book under review was engaged in warlike operations on the side of a belligerent, which had not seen fit to pay Mr. Whitehead the price demanded by him for initiation into the mysteries of his torpedoes. That belligerent was attacked by some of these weapons which proved ineffectual, and very wisely determined to discover what he could concerning his enemy's equipment when a portion of it fell into his hands. Commander Sleeman has, therefore, obtained a knowledge of the secret in a perfectly honourable manner, and his conduct in making it known is thoroughly justifiable. The addition he makes to our knowledge by publishing it is not, however, very considerable, as some months ago a paper appeared in an Austrian magazine, which told us nearly as much on the subject as can be found in our author's pages. But there is no doubt that we have here, in an apparently accurate shape, the first full account of this celebrated torpedo that has been published in English. In his narration of its performances, Commander Sleeman relates a story about which we should like to have a little more information. He says—avowedly following Lieutenant Arnault and Captain Chardonneau, translations of whose articles have already appeared in the *Journal*—that a Turkish vessel was destroyed by a Whitehead at Batoum, on the night of the 25th–26th January, 1878. Now Admiral Hobart Pasha, writing in the "North American Review," nearly a year after that date, makes no mention of this, and states that the "Seif" was the only Turkish vessel destroyed by an *offensive* torpedo during the war. The Admiral must have known all that took place on the occasion, and it is hardly to be sup-



posed that he would have passed over this event, which, if it really occurred, was on the single occasion when a fish-torpedo succeeded in actual warfare. It should be observed that Commander Sleeman does not allude to the unsuccessful attempt made by the boats of Her Majesty's ship "Shah," to destroy the Peruvian ship "Huascar," when at anchor, with one of these weapons. We believe, by the way, that the name of its original inventor was Luppis, and not Lupius, as given by Commander Sleeman. We should strongly advise any Officers about to join a class on board Her Majesty's ship "Vernon," who have not received any previous instruction in the subject, to consult this book.

B.

---

*Almanach für die k. k. Kriegs-Marine, auf das Schaltjahr 1880.* Laibach. Ig. v. Kleinmaye and Fred. Bamberg. (Small pocket-book.)

THIS valuable annual, which has been noticed in the Journal in previous years, again appears for the present year 1880. Both the form and the matter have undergone a certain change since the publication of former editions. Many of the elaborate mathematical formulæ which earlier numbers of the Almanack contained have been omitted: and however Austrian naval Officers may regret their disappearance, there can be but little doubt that foreign Officers, to whom they are readily accessible in works in their own language, will gladly spare them in exchange for the important and interesting information which is given in their stead. The little book can now be purchased in a more completely pocket-book shape than before; and—inside its light and flexible leather cover, provided with double pockets—are to be found the three little volumes among which its four parts are distributed. We have already spoken with approval of the paper and the type with which the book is printed; and we may again say that, in size and shape of page, texture of paper, and clearness of letter-press, it approaches more nearly to the perfection of an Officer's pocket-book than any with which we are acquainted.

Of its contents it would be hardly safe to express such unqualified commendation. Primarily intended for the Officers of the Imperial-Royal Austrian Navy, it naturally contains much that would be of only secondary interest and limited value to Officers of other Services. But of the information to be found in it, which is of general importance to the naval world, much consists of that particular form of "naval intelligence" which is rarely published in this country, viz., more or less minute accounts of the *matériel* of every Navy in existence. Nearly every European Service has some *Marine Almanach* or *Carnet des Officiers*, in which accurate information concerning the ships and armament of foreign Powers is to be found. The British stands alone in this respect, being the solitary instance of a great European Navy which is, up to the present, altogether without some succinct and trustworthy account of the forces of its maritime rivals. To the increasing section of naval Officers, who desire to learn what foreign countries are in possession of in the way of ships and ships' guns, this little pocket-book may be confidently commended.

The first part, having an almanack and a few useful tables in the beginning, is chiefly taken up with lists of Officers of different ranks in the Imperial-Royal fleet: and is, in fact, an Austrian Navy List. The third part contains an index to the "Service Regulations." The fourth is devoted to a reproduction of certain official orders, lists of pay, scales of victualling, &c. The only portions of it deserving of notice are a table of relative rank of Officers of all Navies in Europe and the United States; and tables of complements of the different Austrian ships-of-war. The second part, the consideration of which we have left to the last, is the one which English Officers will find of

most interest and of the greatest value. It contains a complete list of the ships of all the Navies in the world; and detailed tables of the several descriptions of naval ordnance in existence with an estimate of their powers. These lists, as far as we have been able to examine them, appear very correct, and that they have been brought up to the latest date possible, will be seen from the fact that the late Peruvian armour-clad "Huascar" is given amongst the vessels now belonging to the Chilean Navy. A new feature of this part is a table showing the least powerful guns made on the Krupp, French, and Woolwich systems which will pierce the armour of the more important armour-clads of the different maritime States. On the whole the book is surprisingly correct, and we have been able to find but few inaccuracies in its statements relative to foreign forces. There are some, however, and the following may be noted:—At page 69, the heavy guns of the "Huascar" are given as 9-inch Whitworths, this should be altered to 10-inch 12-ton Armstrongs, the old-fashioned 300-pounders. In the list of the Greek Navy, the new armour-clad, "Navarchos (Admiral) Miaulis," recently built by the Forges et Chantiers Company in France, is not given. In the list of the Russian ships the name of the "Rossia" appears twice amongst the purchased unarmoured cruisers. The thickness of the armour of the old and small Japanese ship, "Rio-jio-kan," is given as 6 inches, it is not more than 4½. There are a few mis-statements concerning the ships of our own Navy which any English Officer will at once detect; they are not, however, very important. Part II is eminently deserving of the notice of British naval Officers. It may be mentioned that though this almanack is not usually on sale by English booksellers, it may be ordered through any of the foreign publishers in London.

B.

---

*Carnet de l'Officier de Marine.* Agenda Vade-Mecum ou Recueil de Renseignements à l'usage des Officiers de la Marine Militaire et de la Marine de Commerce. 2e Année. 1880. Paris: Berger-Levrault et Cie., Editeurs de la *Revue Maritime et Coloniale* et de *l'Annuaire de la Marine*. (Pocket-book size, 3s.)

We not infrequently boast, and as a rule with good reason, that in this country when any want has to be supplied we seldom wait for the Government to take the initiative. It is not uncommon to hear our merits in this respect favourably contrasted with the failings of our neighbours, whose adhesion to the doctrine of *laissez faire* is held to be less practical than our own. There seems to be a strange inversion of a practice that is nearly general in matters connected with the Navy. Few things could show that better than the publication of the above-named little work. A French publisher has been found of sufficient enterprise to produce just the handy and instructive little pocket-book which is required by naval Officers. We say this without in the least wishing to disparage the well-established merits of Captain Bedford's valuable miniature Cyclopaedia. The "Carnet" before us is of just the dimensions to be put into a moderate sized pocket, and contains just the information which an Officer desirous of keeping himself informed of the condition of his own and foreign fleets will find useful. The little book is evidently a copy of the "Marine Almanack" of the Austrian and German services, and apparently a copy rather improved. Being in French it will, very likely, prove more generally serviceable to our own Officers than if it had been, as those works are, in a language less commonly known in our Navy. A succinct account of what it contains will render clear how excellent a compilation it is.

At the beginning is printed an abridged "Nautical Almanack," with a

selection of elements sufficient to enable an observer to work out the usual astronomical observations taken in the navigation of ships. Several useful tables with their explanations are added, as well as examples of the working out of some necessary calculations. Paris time is of course used throughout, so this part of the book would not prove of much use to navigators who work from Greenwich. We may see from it, nevertheless, how handy such an abridgement is. Following this is a series of mathematical formulæ and tables, including one of the logarithms of numbers from 1 to 1,000. Then come certain ballistic formulæ for the solution of gunnery problems, a table for estimating distances at sea, and curves of penetration of armour by projectiles, taken, as is a table following, from the Austrian Almanack. After this we find very full descriptions in tabular form of the French naval ordnance, including pieces of the 1875 pattern. This alone ought to render it useful to foreign Officers. The next division is composed of lists, usually with exceptionally full details, concerning the ships of the navies of the world. This portion, consisting as it does of masses of figures, is naturally not quite free from mistakes. We may for instance mention that the "Independencia" and the "Neptune," one and the same ship under different names, appear on the list of both the Brazilian and English navies; the American list evidently requires revision. The most striking feature of this part is the ample information given concerning the French ships, from which the prodigious progress made of late by France in the reconstruction of her navy may be perceived. Among the remaining contents are, an account of the organization of the French Navy, which is in effect the same as one which was contributed to this Journal by Captain Needham, R.M.A.,<sup>1</sup> tables of pay of officers, a complete French Navy List, certain official regulations, the Rule of the Road at Sea, lists of foreign moneys, &c., and tables for converting French measures into English. The last section is an abridged "Admiralty Manual of Scientific Inquiry." The print is very small but at the same time clear; there are several blank pages, and a sheet of prepared paper for erasable memoranda at the end.

NOTE.—It is intended to insert, in the next number of the Journal, lists of armoured ships and of unarmoured ships of the newest type belonging to different foreign navies.—L. A. H.

*Le Feu Rapide de l'Infanterie, son Passé et son Avenir.* By B. J. I. de P. Paris: J. Dumaine. 2fr. 50c. Pp. 98. Size 9" x 5½". Weight under 6 ozs.

THE author of this pamphlet informs us that he was an eye-witness of the late war in Turkey. It is written chiefly to show the value of the Konka "quick-loader," when applied to ordinary breech-loading rifles as compared with magazine weapons. This apparatus is based on the idea that it is better to apply to the weapons now in use a means of facilitating the loading motions, than to introduce an entirely new armament, which would be necessary were repeating rifles adopted for the infantry. It consists essentially of two parts, the one the packet of cartridges, the other the bracket by which this is affixed to the rifle just in front of the breech-action. The cartridge-packet is made of cardboard varnished. It is constructed to hold eight to ten cartridges, and these are placed in its base uppermost, so that the case has the shape of a truncated pyramid. The whole of the soldier's ammunition is made up in these packets. When it is desired to fire rapidly,

<sup>1</sup> No. xci, 1877.

one of the cases is placed in the holder, which consists of a bracket frame fixed to the right side of the rifle by means of two spring arms which go round the rifle just in front of the breech. The sides of the frame are made to correspond to the shape of the packet of cartridges, and are further provided with springs to hold it steady. When the soldier now desires to load, instead of having to feel for a cartridge in his pouch, he sees a packet before him, arranged so as to be readily accessible and close to the place in which the cartridge has to be put. When one packet is exhausted the empty case is ejected by a slight blow from beneath and a full one put in its place. Extensive experiments have been conducted with this apparatus in Russia, and they would seem to show, that although by its use the fire is not so rapid as that from a repeating rifle, so long as the magazine of the latter remains charged, yet, that should the fire be prolonged, more rounds can be fired off in a given time by means of the quick-loader than by any other system yet devised. In addition to the description of the above apparatus, the pamphlet contains a short account of the effect of rifle-fire in former wars. That portion which deals with the Russo-Turkish War will be found particularly interesting as giving the evidence of an eye-witness as to what actually took place. The recent experiments made in France are also dealt with, and the *brochure* finally ends with a description of the probable uses of the Konka quick-loader in war

W. H. J.

---

*Le Tir de l'Infanterie aux grandes distances et son influence sur la tactique.*

By Captain Vermerch. Brussels Nourquardt. 3 fr. Pp. 153. Size 9" x 6". Weight under 12 ozs.

A FAIR summary of the present state of the long-range infantry-fire question, compiled from the best authors that have written on this subject, well adapted for those who desire to know what is thought on this matter on the Continent.

W. H. J.

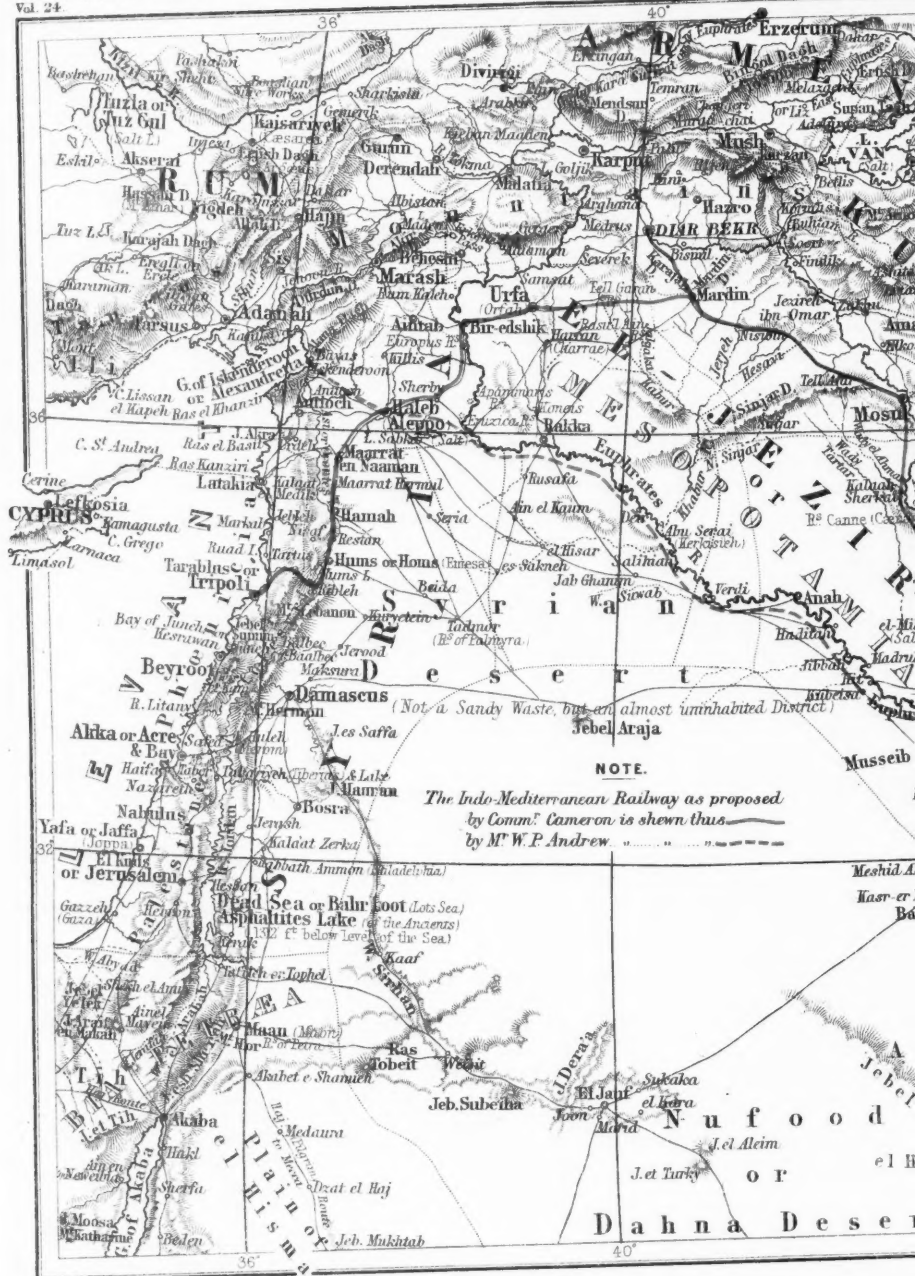
g  
t  
7  
k  
e  
a

e.  
X

n,  
ell  
he

Especially with reference to a propos

Vol. 24





# TAIN CAMERON'S TRAVELS IN MESOPOTAMIA.

ce to a proposed Indo-Mediterranean Railway

PL IV

